Ecological and Human Use Information for Twenty Areas on the Atlantic Coast of Nova Scotia in Support of Conservation Planning

A.G. Gromack, K. Allard, D. Fenton, S. Johnston, and J. Ford

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Acronyms

BCAF	Bluenose Coastal Action Foundation
BLI	BirdLife International
CBD	Convention on Biological Diversity
CEPI	Collaborative Environmental Planning Initiative
CHS	Canadian Hydrographic Service
COP	Conference of the Parties
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CPANS	Coastal Protected Areas of Nova Scotia Working Group
CPAWS-NS	Canadian Parks and Wilderness Society, Nova Scotia Chapter
CTD	Conductivity and Temperature at Depth
CWS	Canadian Wildlife Service
DFO	Fisheries and Oceans Canada
EBSA	Ecologically and Biologically Significant Areas
EGSPA	Nova Scotia Environmental Goals and Sustainable Prosperity Act
EHJV	Eastern Habitat Joint Venture
EMP	Environmental Monitoring Program
EOAR	Ecosystem Overview and Assessment Report
FSC	Food, Social, and Ceremonial
FSRS	Fishermen and Scientists Research Society
IBA	Important Bird Area
IEP	Inshore Ecosystem Project
IUCN	International Union for the Conservation of Nature
LEK	Local Ecological Knowledge
LFA	Lobster Fishing Area
MARFIS	Maritime Fishery Information System
MBS	Migratory Bird Sanctuary
MPA	Marine Protected Area
MWA	Marine Wildlife Area
MWI	Maritimes Wetland Inventory
NaGISA	Natural Geographic Inshore Areas Project
NCC	Nature Conservancy of Canada
NMCA	National Marine Conservation Area
NPRI	National Pollutant Release Inventory
NSDNR	Nova Scotia Department of Natural Resources
NSE	Nova Scotia Environment
NSNT	Nova Scotia Nature Trust
NWA	National Wildlife Area
RLUL	Restricted and Limited Use Lands
SARA	Species at Risk Act
SHACI	Significant Habitats: Atlantic Coast Initiative
TEK	Traditional Ecological Knowledge
VDC	Virtual Data Centre

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Abstract

Nova Scotia is inherently dependent on its coastal and ocean resources. Several federal and provincial policies are in place or being developed to improve coastal management in Nova Scotia to ensure sustainable development while maintaining the ecological integrity of coastal environments. Nevertheless, the Atlantic coast of Nova Scotia has very few protected areas in marine waters, representing a major gap in the proposed national network of Marine Protected Areas (MPAs). This report is intended to be a foundation document, providing information that may be used to identify priority areas for conservation to be addressed using a variety of management measures, including MPAs. It may also help advance collaboration between federal and provincial departments with protected area and coastal management mandates. As a first step it provides an ecological and human use overview of twenty coastal areas on the Atlantic coast of Nova Scotia. This first step will help form the basis for a more systematic approach to conservation planning along the Atlantic coast of Nova Scotia. It will be a valuable resource in implementing the *National Framework for Canada's Network of Marine Protected Areas* on the Atlantic coast of Nova Scotia, which is currently being developed by DFO at the national level in collaboration with the Canadian Wildlife Service, Parks Canada, and provincial and territorial representatives.

This report describes the methodology by which the twenty coastal sites were identified, provides detailed site descriptions on the ecological attributes within each site and provides information on the human uses, research, and conservation initiatives that occur within each site. There are numerous data gaps along the Atlantic coast of Nova Scotia which are important to address for systematic conservation planning. Some data gaps are discussed in greater detail in this report and suggestions are made as to how these may be addressed. As data gaps are numerous, efforts to address these may be more effective if focussed on particular sites rather than coast-wide. The recommended next steps for coastal conservation along the Atlantic coast of Nova Scotia include: ensuring stakeholder input throughout the planning process, developing a coastal conservation areas planning and implementation framework including setting broad goals and specific conservation objectives, collecting detailed socio-econimc information, addressing data gaps, and further evaluating the twenty sites to identify whether they may be considered as potential priority areas for conservation.

Résumé

La Nouvelle-Écosse est essentiellement tributaire de ses ressources côtières et maritimes. Plusieurs politiques fédérales et provinciales déjà en place ou en cours d'élaboration visent l'amélioration de la gestion côtière en Nouvelle-Écosse pour assurer le développement durable et le maintien de l'intégrité écologique des milieux côtiers. Toutefois, on ne compte que très peu de zones protégées le long du littoral atlantique de la Nouvelle-Écosse, ce qui constitue une lacune importante dans le réseau national proposé de zones de protection marine (ZPM). Conçu comme document de base, le présent rapport présente des données susceptibles de servir à désigner des zones prioritaires pour la conservation, y compris des ZPM, dans lesquelles on mettra en place diverses mesures de gestion. Il pourrait également permettre de renforcer la collaboration entre les ministères fédéraux et provinciaux dont la gestion des zones protégées et des zones côtières fait partie du mandat. Tout d'abord, il présente un tour d'horizon de l'écologie et de l'utilisation anthropique de vingt secteurs du littoral atlantique de la Nouvelle-Écosse. Cette première étape permettra de constituer la base d'une approche plus systématique de la planification de la conservation le long du littoral atlantique de la Nouvelle-Écosse. Ce sera un document très utile pour la mise en œuvre du *Cadre national pour le réseau d'aires marines protégées du Canada* le long du littoral atlantique de la Nouvelle-Écosse. Pêches et Océans Canada élabore actuellement ce cadre à l'échelon national, en collaboration avec le Service canadien de la faune, Parcs Canada et des représentants des provinces et des territoires.

Le présent rapport décrit la méthode utilisée pour désigner les vingt secteurs côtiers en question, présente une description détaillée des caractéristiques écologiques de chaque secteur et des renseignements sur les activités anthropiques, les activités de recherche et les initiatives de conservation qui sont menées dans chaque secteur. De nombreuses lacunes dans les données existent pour le littoral atlantique de la Nouvelle-Écosse. Il est important de combler ces lacunes pour la planification systématique de la conservation. Certaines de ces lacunes sont exposées de façon détaillée dans ce rapport et des suggestions sont formulées quant aux mesures à prendre pour les combler. Étant donné le grand nombre de lacunes, les efforts visant à y remédier pourraient être plus efficaces s'ils portent sur certains secteurs en particulier plutôt que sur l'ensemble du littoral. Au nombre des prochaines étapes recommandées pour la conservation des zones côtières du littoral atlantique de la Nouvelle-Écosse, citons les suivantes : combler les lacunes dans les données, voir à la participation des parties concernées à toutes les étapes du processus de planification, élaborer un cadre de planification et de mise en œuvre des aires de conservation côtières, notamment fixer des objectifs généraux et des objectifs précis de conservation et poursuivre l'évaluation des vingt secteurs visés afin de savoir s'ils peuvent être considérés comme étant de possibles zones prioritaires pour la conservation.

1.0 Introduction

Coastal ecosystems are some of the most productive ecosystems on Earth (Halpern *et al.* 2009, Waycott *et al.* 2009). Increasing pressures from human uses both on land and within the marine environment are compromising the ecological integrity of important coastal ecosystems worldwide (Cohen 2003; Halpern *et al.* 2009). With a variety of habitats and ecosystem features, coastal zones are highly biodiverse and provide invaluable ecosystem services (Costanza *et al.* 1997). These services benefit coastal communities which depend on coastal resources for their livelihoods. Bays and inlets with kelp and eelgrass habitats provide refuge for a variety of fish species, protecting valuable fishery resources (Waycott *et al.* 2009); highly productive and biodiverse areas represent ecologically healthy areas that encourage sustainable recreation and tourism; and coastal wetlands improve water quality and protect against erosion and flooding (*Ibid.*). Ecosystem services are being impacted as biodiversity is lost due to increasing anthropogenic impacts on coastal and marine environments (Worm *et al.* 2006). International efforts to address the threats to these important coastal ecosystems include integrated coastal zone management and the use of specific management tools such as marine protected areas.

Nova Scotia, a province almost entirely surrounded by ocean, is inherently dependent on its coastal and ocean resources. Cultural ties to the coast are embedded in a long history of fishing and marine transportation for which many coastal communities still depend. Significant efforts are being made within the province to improve the management of coastal environments through the development of several policies including the Nova Scotia Coastal Strategy (NSDFA 2008), the Nova Scotia Wetland Conservation Policy which is undergoing consultation (Province of Nova Scotia 2009a), and the Nova Scotia Water Resources Management Strategy which is also underway (NSE 2010). However, Nova Scotia is one of two coastal provinces that lacks a core federal Marine Protected Area (MPA), as defined by *Canada's Federal Marine Protected Areas Strategy* (Government of Canada 2005), in the coastal zone. There is a need to protect important coastal marine ecosystems in Nova Scotia, some of which remain relatively pristine, using a variety of conservation measures including federal MPAs.

Over the long-term, the coast of Nova Scotia requires a coastal conservation areas planning and implementation framework as part of a broader coastal management plan. This could contribute to the Nova Scotia Coastal Strategy which is in development (NSDFA 2008) and to other coastal initiatives. This framework would set the foundation for a systematic approach to the identification of priority areas for coastal conservation (both terrestrial and marine) using a variety of management measures including federal MPAs, provincial protected areas, and potentially other management tools such as fisheries restrictions or closures. Systematic planning (*e.g.* MPA network planning) increases the transparency of site selection by providing clear objectives through which individual sites act cohesively to achieve broader conservation goals (Smith *et al.* 2006).

Under the Government of Canada's Health of the Oceans (HOTO) Initiatives, Fisheries and Oceans Canada (DFO) is committed to developing a federal-provincial-territorial MPA network (DFO 2007a). A *National Framework for Canada's Network of Marine Protected Areas* is currently being developed by DFO at the national level in collaboration with the Canadian Wildlife Service, Parks Canada, and provincial and territorial representatives to set the direction for network planning and implementation at regional scales (DFO 2010a). The network will comprise individual networks developed at the smaller, bioregional scale. Bioregions are bio-geographic units derived from expert advice that will contribute to advancing Canada's commitment to develop networks of representative MPAs that meet its obligations under the Convention on Biological Diversity (for a map of Canada's bioregions see Appendix A, DFO 2009a).

The Scotian Shelf Bioregion aligns closely with DFO's Maritimes Region boundaries and requires a planning and implementation framework with goals and specific objectives. The Atlantic coast of Nova Scotia is one component of the bioregion which also includes the Bay of Fundy and the offshore Scotian Shelf. Conservation planning along the Atlantic coast of Nova Scotia will complement existing planning efforts in the offshore Scotian Shelf area of Nova Scotia (DFO 2009b).

Ecological information along the Atlantic coast of Nova Scotia is sparse with few regionally based surveys to identify ecologically important areas consistently and comparatively. Therefore, the methods for identifying priority ecological areas within the coastal zone will aim to identify areas of known significance in a context of limited information and will differ from those methods used in the preliminary offshore MPA network planning exercise (DFO 2009b), where there is a greater availability of scientific data.

1.1 Purpose and Scope

The information in this report was primarily collected to inform DFO's *Oceans Act* MPA and Conservation Planning Program within coastal Nova Scotia. At the time of writing, there is no immediate commitment from DFO to identify and advance a particular site emerging from this work. As a foundation document, it does provide essential information that would be used to select an appropriate site in this study area when the required resources are available and opportunities arise (including stakeholder input). Secondarily, in the process of assembling this information and consulting with other conservation specialists, the purpose of this report has been broadened to help address the need for coastal conservation more generally in Nova Scotia. It is hoped this report will contribute to current and emerging coastal management initiatives in Nova Scotia by helping to distinguish twenty areas[1] for which additional attention may be required and a variety of conservation tools may apply. This compilation will be a valuable resource in implementing the *National Framework for Canada's Network of Marine Protected Areas* (DFO 2010a) along the Atlantic coast of Nova Scotia.

The study area for this initiative is the Atlantic coast of Nova Scotia from Lobster Bay (beginning at Big Tusket Island) to Cape North, Cape Breton, and extends approximately 12 nautical miles seaward. The landward boundary is set at the high-water mark, however, much of the information in this report is subtidal in scope to address the greater need for conservation in the marine coastal environment where there is minimal protection.

Although a coastal conservation areas planning and implementation framework should be fully developed for the Atlantic coast of Nova Scotia, the required conservation objectives have not been developed but are part of the next phase of work (see Next Steps, Section 7.0). In addition to the information that this report provides, a systematic assessment to identify sensitive coastal areas along the Atlantic coast of Nova Scotia is required. This will add a layer to this analysis to help further refine priority areas. When these next steps are completed, all twenty areas highlighted herein may or may not be identified as priority areas for coastal conservation as each area will need to be assessed against the broader conservation objectives which have yet to be identified. The twenty sites assessed in this report are listed below and their locations are illustrated in Figure 3.4.

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[1] The boundaries described and shown for each of the twenty sites are only study area boundaries for the purpose of this report. They do not represent any future management boundary and do not imply any regulatory or management response.

Twenty Coastal Areas Assessed in this Report:

1. Lobster Bay
2. Cape Sable Island
3. Port Joli / Kejimkujik Seaside Adjunct
4. LaHave River and Islands
5. Mahone Bay and Islands
6. St. Margaret's Bay
7. Eastern Shore Islands WMA
8. The Canso Ledges
9. Mira Bay and Scatarie Island
10. Bird Islands
11. St. Paul's Island
12. Bras d'Or Lakes
13. Port l'Hebert
14. Cole Harbour Estuary
15. Chezzetcook Inlet to Jeddore Harbour
16. Taylor Head to Sheet Harbour
17. St. Marys River and Watershed
18. Janvrin Islands
19. Big Glace Bay
20. Western Sydney Bight

Although these areas were chosen using criteria for DFO's MPA and conservation planning program as well as input from other federal and provincial representatives (see Methodology, Section 3.0), they may not be deemed the most ecologically significant areas from the perspective of other federal and provincial agencies involved in conservation planning and protected area establishment (see Section 2.2 and 2.3 describing federal and provincial protected area programs). However, this report brings together ecological information for coastal areas that will be valuable for several coastal management initiatives. It serves as an important compilation for coastal conservation planning and will bring awareness of this work to government and non-government organizations with similar initiatives. It will also be useful for engaging stakeholders. The areas identified within this report are based on known significance, primarily utilizing existing compilations and expert opinion as a starting point. This does not imply that other areas along the Atlantic coast are not significant and as more information becomes available additional areas may be assessed.

2.0 Coastal Initiatives and Protected Area Programs in Nova Scotia

This section describes coastal management and policy initiatives which are underway in Nova Scotia as well as federal and provincial protected area programs that can provide protection of coastal lands and waters. Although there are several protected area designations that can offer protection to coastal areas, including sensitive ecosystems and habitats, many of these designations are underutilized within the marine environment. For additional information on federal MPA programs, refer to *Canada's federal marine protected areas strategy* (Government of Canada 2005) in the References section. The table found in Appendix B summarizes protected areas administered by the Government of Nova Scotia.

2.1 Coastal Initiatives

Planning for coastal conservation will require stakeholder engagement and coordination with federal and provincial agencies undertaking coastal initiatives. There are several coastal research initiatives that are mentioned in the site profiles (Section 4.0). Major coastal management and policy initiatives within Nova Scotia are described below.

- The Eastern Scotian Shelf Integrated Management (ESSIM) initiative is a collaborative ocean planning process being led and facilitated by DFO, Maritimes Region, under Canada's *Oceans Act* (DFO 2007b). ESSIM is currently focused in the offshore, however, there is a long-term commitment to build upon this work for integrated management of the coastal zone (DFO 2007b).
- The Bras d'Or Lakes Collaborative Environmental Planning Initiative (CEPI) is a gathering of government, private industry, community interests, and First Nations who meet monthly to discuss issues facing the Bras d'Or Lakes (CEPI 2004). CEPI is developing an integrated management plan for the Bras d'Or Lakes which aims to address the land-based impacts in the area.
- The Nova Scotia Department of Fisheries and Aquaculture released their Coastal Management Framework in 2008 which sets out six strategic activities for six priority issues. The first strategic activity is to assess the state of Nova Scotia's coast and establish a Coastal Strategy (NSDFA 2008). The Framework aims to address six priority issues, one of which is Sensitive Ecosystems and Habitats (NSDFA 2008). Coastal MPAs are an obvious tool to address this issue by means of legal protection. The first portion of the aforementioned strategic activity has been completed with the release of the *2009 State of Nova Scotia's Coasts Technical Report: Our Coast. Live. Work. Play. Protect.* (CBCL Limited 2009) on December 9th, 2009 and the development of the Coastal Strategy was underway at the time of writing.
- Nova Scotia Department of Natural Resources (NSDNR) is developing a *Natural Resources Strategy* for minerals, parks, forests and biodiversity. The *Natural Resources Strategy* is legislated to be released to the public by 2010 in accordance with the *Environmental Goals and Sustainable Prosperity Act* (EGSPA) (NSDNR 2009b). MPAs may link to the biodiversity strategy, as they can be used to maintain biodiversity in marine and coastal environments through legal protection.
- Nova Scotia Environment released the draft Nova Scotia Wetland Conservation Policy for consultation ending on December 21st, 2009, as required under EGSPA. The draft Policy goal is: "To prevent the net loss of wetlands in Nova Scotia through wetland conservation practices that balance the need for wetland protection with the need for sustainable economic development, now and in the future" (NSE 2009a). One of the objectives of the draft Policy is to manage human activity with the goal of "no loss" of "Ecologically Significant Wetlands".

"Ecologically Significant Wetlands" include but are not limited to: all salt marshes, wetlands within a variety of protected areas including Ramsar sites, and wetlands known to support species at risk under the *Species at Risk Act* (SARA) or the *Nova Scotia Endangered Species Act* (NSE 2009a). MPAs may be used as a tool for the protection of salt marshes as per this policy, however, *Oceans Act* MPAs cannot extend above the low-water mark where salt marshes are located. Other federal and several provincial protected areas may be established to protect salt marshes (see Section 2.3).

- Nova Scotia Environment is legally obligated under EGSPA to produce a Water Resources Management Strategy (NSE 2007), however, the linkage of this strategy to MPA planning pertains to areas where the zone of influence of fresh and salt water is larger, as in estuaries, in which water quality upstream may affect coastal water quality and vice versa.

2.2 Federal Marine Protected Area Programs

DFO is mandated to lead and coordinate the development and implementation of a national system of marine protected areas and designate MPAs under the *Oceans Act* (s. 35(2)). Two other federal departments have legislative mandates to establish MPAs: Environment Canada and Parks Canada. Environment Canada designates National Wildlife Areas (NWAs) and Marine Wildlife Areas (MWAs) under the *Canada Wildlife Act*, as well as Migratory Bird Sanctuaries (MBSs) under the *Migratory Birds Convention Act* which all contribute to the federal MPA network provided they contain a marine component (Government of Canada 2005). The Canadian Wildlife Service (CWS) of Environment Canada administers NWAs, MWAs and MBSs. Parks Canada establishes National Marine Conservation Areas (NMCAs) under the *Canada National Marine Conservation Areas Act* and may also establish National Parks with marine components under the *Canada National Parks Act* (Government of Canada 2005).

In addition to collecting information relevant to *Oceans Act* MPAs, this report includes information as it pertains to the general mandates of Parks Canada and Environment Canada. For example, some information on cultural values for each site is noted in the site descriptions in support of Parks Canada's mandate to "protect and present nationally significant examples of Canada's natural and cultural heritage and foster public understanding, appreciation and enjoyment…" (Parks Canada 2009). Habitat information and ecosystem type is included to support an evaluation of representation, which will also be taken into account in the development of network objectives not only for the mandate of Parks Canada, but also in accordance with the Convention on Biological Diversity's Conference of the Parties (COP) 9 Decision IX/20 providing scientific guidance to establish MPA networks (CBD 2008). CWS works to protect and manage migratory birds, nationally important wildlife habitat, and endangered species (CWS 2009). This report includes a summary on the importance of each area for birds and also identifies the presence of species and birds listed under the *Species at Risk Act* (SARA) or assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

2.3 Provincial Protected Area Programs

There are several provincial protected area programs within Nova Scotia, some of which allow for protection to extend into the marine environment. Protected areas administered by NSDNR include Wildlife Management Areas (WMAs), Game Sanctuaries, Provincial Parks and Park Reserves, and Protected Beaches. Many of these areas extend into the marine environment, especially to protect intertidal areas and to limit access to these areas. Nova Scotia Environment designates Wilderness Areas and Nature Reserves, some of which are located on the coast but do not contain marine waters. However, the respective Acts for these designations, the *Wilderness Areas Protection Act 1998* and the *Special Places Protection Act 1989*, allow for the protection of water-covered land with no specified limits. The Nova Scotia Department of Tourism, Culture and Heritage also designates protected areas termed Protected Sites which are areas of historical, archaeological, and palaeontological significance.

This report should contribute to knowledge of the marine environment which is interconnected to intertidal and terrestrial areas that are of importance to the above provincial agencies and others. Although the primary purpose of this report is to compile marine ecological and human use information, an overview of the cultural and recreational significance of these areas and surrounding coastline is also noted within the site profiles.

As noted earlier, it is hoped this report can assist with coastal management efforts broadly, particularly those identified within the Nova Scotia Coastal Strategy being advanced by the Nova Scotia Department of Fisheries and Aquaculture (NSDFA 2008).

3.0 Methodology

The twenty sites identified within this report provide a starting point for the eventual prioritization of areas for coastal conservation planning. The methodology described below is a first step in identifying areas of known significance. A critical next step is to obtain stakeholder feedback on these areas that were chosen and the information that is presented on each area and to collect more detailed socio-economic information for each area. Stakeholder feedback will build upon the work that is presented in this report by informing the selection of priority areas for coastal conservation and by supplementing the information presented in this report with local ecological knowledge (LEK) and other sources of information that are not publicly available. This is further discussed in Section 7.0.

The twenty sites described within this report (Type I and II Sites) were identified using the methodology described in Section 3.1. This was followed by collecting available information relevant to protected area and conservation planning from a variety of sources including primary and secondary literature, websites, government databases, unpublished data, and other grey literature. Sources of information are discussed in Section 3.2.

3.1 Site Selection Methodology

The site selection methodology was conducted in two steps. Step 1 involved filtering an initial set of 47 sites described by Doherty and Horsman (2007) into a more manageable number for assessment. Step 2 involved the addition and shifting of sites into different categories by examining other sources of information and incorporating input from other government departments. The steps are broken down in detail below.

Step 1 – Refining Ecologically and Biologically Significant Areas (EBSAs)

There are few studies that have identified areas of ecological significance in coastal Nova Scotia. The identification of Ecologically and Biologically Significant Areas (EBSAs) is intended to raise awareness of areas which require management attention and potentially to identify MPAs (DFO 2004a). EBSAs can be identified in a number of ways. The only complete analysis identifying inshore EBSAs along the Atlantic coast of Nova Scotia was conducted in 2006 at a workshop that brought scientific experts in the region together to identify EBSAs. The proceedings report is titled: *Ecologically and Biologically Significant Areas of the Scotian Shelf and Environs: A Compilation of Scientific Expert Opinion*. See the boxed feature below for further information. The Inshore Ecosystem Project described in Section 3.2 is intended to further refine the EBSAs identified in the 2006 workshop. Although the 2006 EBSAs were not reviewed through the DFO formal peer review process using the Canadian Science Advisry Secretariat, this report is used as an initial basis for selecting the twenty sites. It is the most recent, and one of only two analyses of this nature that examines the entire Atlantic coast of Nova Scotia. The only other study that examines the entire Atlantic coast is the study by Lane and Associates (1992).

At the EBSA workshop, 47 inshore areas were identified for their ecological significance. Figure 3.1 shows the EBSAs identified in the 2006 workshop. Figure 3.2 demonstrates the number of times EBSAs were identified by scientific experts. Participants included representatives from DFO's Science Branch (with a wide range scientific expertise), DFO's Oceans, Habitat and Species at Risk Branch, scientists from other federal and provincial government departments, the Fishermen and Scientists

Research Society (FSRS), academics, consultants and Environmental Non-Government Organizations (Doherty and Horsman 2007).

Research is underway at nine sites across the Atlantic coast of Nova Scotia that will further contribute to EBSA evaluation (DFO 2006a and 2007b), see the boxed feature on page 18: "The Inshore Ecosystem Project". This information will be valuable in informing this work as it progresses.

Ecologically and Biologically Significant Areas of the Scotian Shelf and Environs: A Compilation of Scientific Expert Opinion
Doherty and Horsman 2007

Ecologically and Biologically Significant Areas (EBSAs) were identified for the offshore and inshore Scotian Shelf during a workshop in 2006 by groups of scientific experts based on the EBSA criteria of uniqueness, aggregation, fitness consequences, naturalness, and resilience. Each group of experts separately identified EBSAs and provided justification for their identification. The scientific experts delineated the EBSAs which were mapped onto two separate maps, one for the offshore and one for the inshore. Doherty and Horsman (2007) cartographically demonstrated the number of times that EBSAs were identified by the different groups. Some areas were identified as many as seven times (i.e. seven separate groups identified the area as an EBSA), whereas most areas were identified between one and two times.

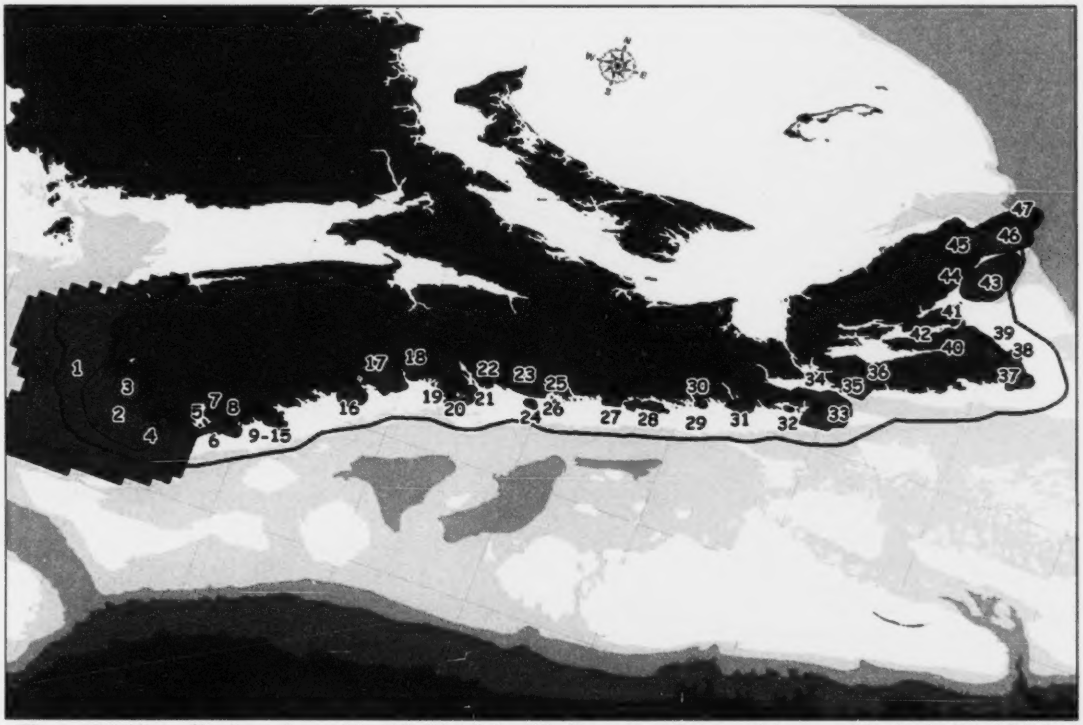


Figure 3.1 Map of Inshore Areas Identified by Scientific Experts as Proposed Areas of Ecological and Biological Significance (Doherty and Horsman 2007). Purple colour delineates EBSAs.

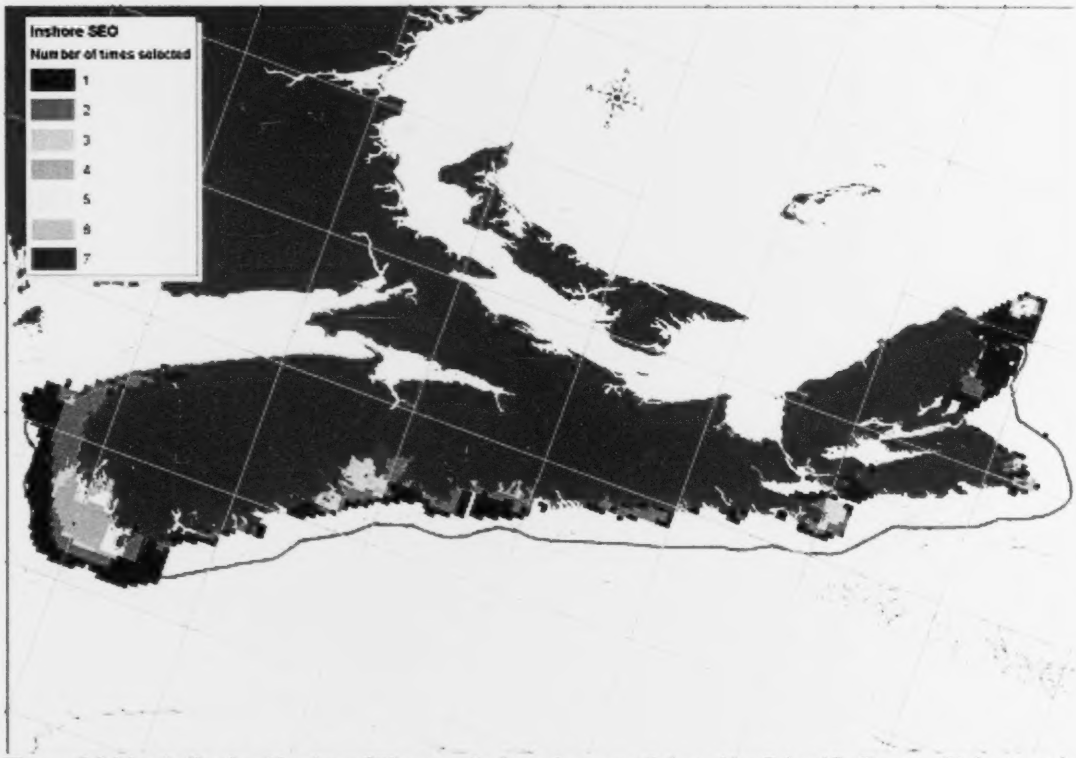


Figure 3.2 Map Indicating Number of Times an Inshore Area was Selected by Scientific Experts (Doherty and Horsman 2007).

The 2006 EBSAs had to be reduced to a manageable number for assessment. The EBSAs were placed into one of three categories termed Type I, II, and III Sites based on the criteria listed in Table 3.1.

The EBSAs were first examined to determine if they meet the *Oceans Act* criteria for designating MPAs, as listed under Section 35 (1):

a) the conservation and protection of commercial and non-commercial fishery resources, including marine mammals and their habitats;
b) the conservation and protection of endangered and threatened species and their habitats;
c) the conservation and protection of unique habitats;
d) the conservation and protection of areas of high biodiversity and high biological productivity and;
e) the conservation and protection of any other marine resource or habitat as is necessary to fulfil the mandate of the Minister.

Section 35(1)e was not applied in the filtering exercise due to its general description. The EBSAs were also filtered according to the number of times they were identified by scientific experts at the 2006 workshop, and the number of primary EBSA criteria they meet. EBSAs which were predominately intertidal were moved from the priority Type I Sites to Type II Sites, as *Oceans Act* MPAs cannot be designated above the low-water mark. Some of the EBSAs in Doherty and Horsman (2007) did not make it into any of the categories. Table 3.1 below describes the selection criteria for Type I, II, and III sites.

Table 3.1 Type I, II, and III Site Criteria

Type I Sites	**Type II Sites**	**Type III Sites**
• Meet at least 2 of 4 *Oceans Act* criteria (determined based on decription in Doherty and Horsman 2007) • Have been selected at least 3 times by scientific experts • Meet at least the three primary EBSA criteria: uniqueness, aggregation, fitness consequences • May also meet other EBSA criteria but this is not a requirement • Not predominately intertidal	• Meet at least 1 of 4 *Oceans Act* criteria (determined based on decription in Doherty and Horsman 2007) • Meet at least the three primary EBSA criteria: uniqueness, aggregation, fitness consequences • May also meet other EBSA criteria but this is not a requirement	• Remaining EBSAs which do not exhibit high degree of uncertainty[1] and were not selected only for significance to birds

[1] Uncertainty is defined in this analysis when adjectives such as "potential" dominated the reason some areas were selected as EBSAs in the 2006 workshop. For example, "potential lobster breeding area" was deemed uncertain. These types of sites were excluded from Type III Sites given the uncertainty.

Table 3.2 shows how the EBSAs fell into the three categories.

Table 3.2 Type I, II, and III Sites. Numbers correspond to those in Doherty and Horsman (2007)

Type I Sites	**Type II Sites**	**Type III Sites**
3 - Lobster Bay* 4 - Cape Sable Island* 16 - LaHave River and Islands area 17 - Mahone Bay and Islands 33 - Canso Ledges area 37 - Mira Bay area and Scatarie Island 41 - Bird Islands 47 - St. Paul's Island area	12 - Port l'Hebert 13 - Port Joli and Kejimkujik Adjunct area 22 - Cole Harbour Estuary 23 - Chezzetcook Inlet to Jeddore Harbour 27 - Taylor Head - Sheet Harbour area 30 - St. Mary's River and watershed 34 - Janvrin Islands 38 - Big Glace Bay 43 - Western Sydney Bight**	15 - Herring Spawning Area of Port Mouton 18 - St. Margaret's Bay area 19 - Terence Bay - Pennant Bay 20 - Sambro Ledges 24 - Yankee Bank (30m depth) 28 - Eastern Shore Islands Wildlife Management Area 35 - St. Peter's Bay- Bay of Rocks 36 - St. Peter's Inlet 39 - Indian Bay and Lingan Bay 40 - Sydney River - Sydney Harbour area 42 - Great Bras d'Or Channel 44 - Ingonish Bay 45 - Asby Bay

*Southwest NS Shelf and Nearshore Southwest NS were identified as EBSAs 1 and 2 in the workshop and were identified as Type I and III sites respectively. They are quite large in size and encompass Lobster Bay and Cape Sable Island. They were therefore excluded from this analysis.

**Cabot Straight to Aspy Bay (EBSA 46) was identified as a Type II Site but was excluded as it is overlaps with St. Paul Island and has features similar to Western Sydney Bight. In a future analysis, this area and Western Sydney Bight may be assessed as one large area.

Step 2 – Refining EBSAs Using Other Information Sources

The EBSA workshop proceedings report is not the only report which identifies areas of ecological significance, however, it is the most comprehensive for this study area. Other government and academic reports have highlighted areas with ecological and biological significance. Nova Scotia Government departments and other federal departments that play a key role in coastal management have also identified areas of ecological significance. The filtering exercise alone is therefore not the only appropriate mechanism for site identification. Type I and II sites were adjusted according to these other sources. Stakeholder feedback is necessary, as mentioned earlier in the report, and is one of the proposed next steps for this work. Type I sites comprise:

(1) Original areas filtered into the Type I category in Step 1;
(2) Coastal areas identified by provincial and federal departments as priority areas for conservation in a working group session hosted by DFO in 2008 (DFO 2009c) and;
(3) Sites which have been identified for ecological significance in other government reports ("Other Sites").

Figure 3.3 represents Step 2 of the site selection methodology, demonstrating the components of final Type I Sites which are deemed as potential high priority sites for *Oceans Act* MPA designations compared with Type II Sites. Note that Type III Sites that did not gain priority and change to Type I and II Sites have been excluded from this report due to time constraints and their lower priority for assessment based on the criteria noted in Table 3.1. Type III Sites and other sites not classified as Type I, II, or III may be identified as ecological priority areas when new information becomes available.

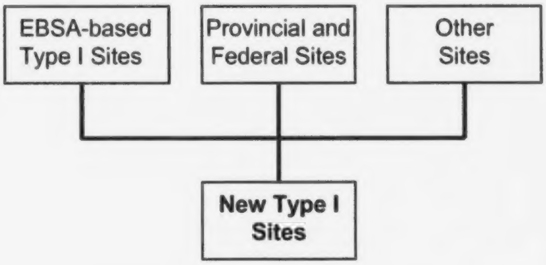


Figure 3.3 Composition of New Type I Sites

Sites of interest to government departments were identified in a brainstorming session held at the Bedford Institute of Oceanography (BIO) on December 10th, 2008 (DFO 2009c). The attendees comprised protected area practitioners in federal and provincial government departments including Parks Canada, CWS, DFO, NSDNR, Nova Scotia Environment, the NS Department of Tourism, Culture, and Heritage and the NS Department of Fisheries and Aquaculture, given their mandate for coastal management. This was the first meeting that brought federal and provincial protected area practitioners together to specifically discuss collaboration for coastal conservation in Nova Scotia. The group was recently named the Coastal Protected Areas of Nova Scotia (CPANS) Working Group which may play a role in future initiatives for coastal conservation in Nova Scotia including in the implementation of the *National Framework for Canada's Network of Marine Protected Areas* along the Atlantic coast of Nova Scotia.

Areas with the highest level of interest for conservation among the members of CPANS in accordance with their departmental mandates for conservation included: Port Joli, the Canso Ledges area, Lobster Bay, and Cape Sable Island. Support was also given for increased protection of the Eastern Shore Islands Wildlife Management Area (WMA) using an *Oceans Act* MPA or other marine management measures. Because of the results of this workshop, Port Joli and the Eastern Shore Islands WMA became Type I Sites.

The Bras d'Or Lakes and St. Margaret's Bay also became Type I sites as they were identified as significant areas in DFO's *Ecosystem Overview and Assessment Report* (EOAR) *of the Bras d'Or*

Lakes, Nova Scotia (Parker *et al.* 2007) and *Significant Habitats: Atlantic Coast Initiative (SHACI) Halifax Regional Municipality – Units 4-6* (McCullough *et al.* 2005), respectively.

New Type I and II Sites are shown on the map below (Figure 3.4) and are re-numbered from the original 2006 EBSA exercise. Although Type I Sites are identified as higher priority sites from an *Oceans Act* MPA perspective, some Type II Sites may be of higher priority within the mandates of other federal or provincial departments. When a coastal conservation planning and implementation framework is developed for Nova Scotia Type I and II Sites will be equally assessed against the objectives determined within the framework, whereas Type I Sites may be more important for DFO's MPA and Conservation Planning Program. Figure 3.5 illustrates the methodology described in this section.

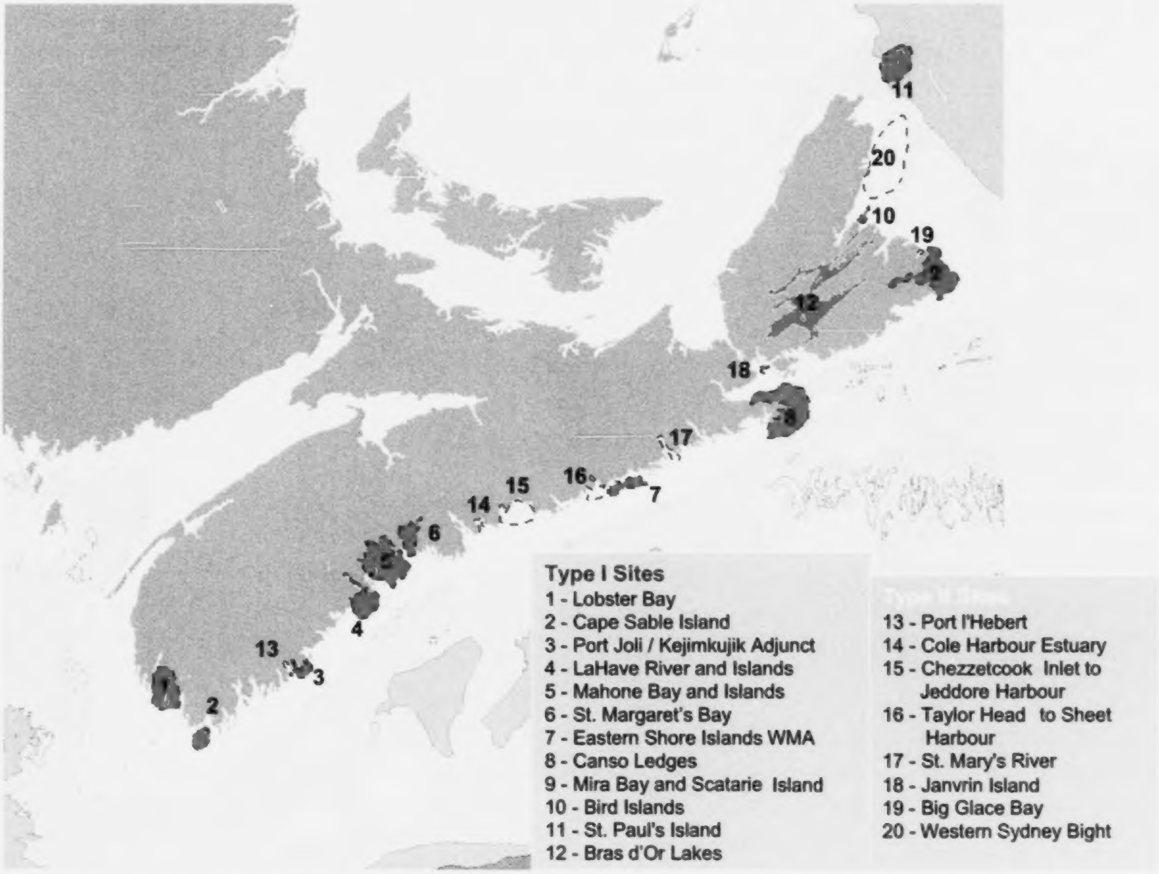

Type I Sites
1 - Lobster Bay
2 - Cape Sable Island
3 - Port Joli / Kejimkujik Adjunct
4 - LaHave River and Islands
5 - Mahone Bay and Islands
6 - St. Margaret's Bay
7 - Eastern Shore Islands WMA
8 - Canso Ledges
9 - Mira Bay and Scatarie Island
10 - Bird Islands
11 - St. Paul's Island
12 - Bras d'Or Lakes
Type II Sites
13 - Port l'Hebert
14 - Cole Harbour Estuary
15 - Chezzetcook Inlet to Jeddore Harbour
16 - Taylor Head to Sheet Harbour
17 - St. Mary's River
18 - Janvrin Island
19 - Big Glace Bay
20 - Western Sydney Bight

Figure 3.4 Type I and Type II Sites. Boundaries are not fixed and correspond with EBSA boundaries.

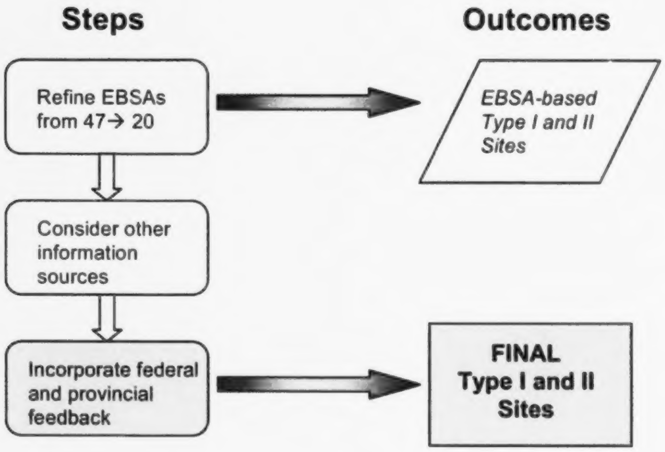

Steps
Outcomes
Refine EBSAs from 47→ 20
EBSA-based Type I and II Sites
Consider other information sources
Incorporate federal and provincial feedback
FINAL Type I and II Sites

Figure 3.5 Summary of Methodology Used to Identify Type I and II Sites for the Purpose of this Report.

3.2 Information Collection

The marine waters of the coastal zone of Nova Scotia are data deficient in comparison with the offshore: "there has been no consistent approach to studying the inshore ecosystem on a coast-wide scale" (DFO 2006a). By contrast, trawl surveys have been conducted over the years in offshore waters for fisheries stock assessments, providing abundant data on the distribution and composition of many types of marine species such as groundfish. Although there are no systematic surveys of the coast, there is a great deal of information on particular areas of Nova Scotia contained in a variety of sources.

This report aims to compile available information on the twenty Type I and II Sites with a focus on information that is relevant for MPA and conservation planning. Ecological information relevant to MPA planning was collected based on the International Union for the Conservation of Nature's (IUCN) *Marine and Coastal Protected Areas: A guide for planners and managers* MPA selection criteria (Salm *et al.* 2000), the *Oceans Act* MPA criteria in section 35 (1), and the CBD COP 9 Decision IX/20 criteria for establishing MPA networks (CBD 2008). Ecological information collected for each site and presented in the site profiles (Section 4.0) is detailed in Table 3.3. Other information collected includes human use information, information on cultural and First Nation significance, and other factors relevant for conservation planning.

Table 3.3 Ecological Information Collected

Criteria	**Sub-criteria**
Species and Habitats	• Spawning or feeding ground for any fishery species including mammals and birds • Nursery area for any fishery species including mammals • Nesting areas for birds • Aggregations of any fishery species including mammals or birds for reasons unknown or different than those above (*e.g.* overwintering areas) • Presence of species listed under the *Species at Risk Act* (SARA) as endangered, threatened or of special concern and species assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as endangered, threatened, or of special concern • Physical and oceanographic parameters creating certain habitat types (*e.g.* salt marshes, dunes)
Biodiversity and Productivity	• Indication of high biodiversity • Presence of eelgrass beds, especially extensive eelgrass beds • Presence of salt marsh, especially extensive salt marshes • Presence of extensive/diverse marine algae • Presence of localized upwelling
Uniqueness	• Ecological features, functions, or processes making this area unique on an international, national, regional, or sub-regional scale • Physical, oceanographic, or chemical features, functions, or processes making this area unique on an international, national, regional, or sub-regional scale • Other attributes not mentioned above making the area unique on an international, national, regional, or sub-regional scale
Naturalness and Vulnerability / Resiliency	• Marine and terrestrial human uses • Presence of shellfish harvesting closures • Level of adjacent coastal/watershed development • Presence and extent of other current or future industrial activities on land or sea • Other factors impacting the marine environment • Presence of individual features that are naturally vulnerable to environmental perturbations (*e.g.* lagoons, barrier beaches, salt marshes)? • Indication of ecosystem resilience • Presence of invasive species • Other forms of contamination

Sources of Information

Some of the resources used in this compilation were not from primary sources including peer-reviewed journals, as there is limited information that is relevant for this compilation that is available from primary sources. When possible, primary, peer-reviewed sources were used. Much of the information was derived from government reports, which are publicly available but are not necessarily primary sources. Reports that are secondary sources include Canadian Technical Reports of Fisheries and Aquatic Sciences (Technical Reports) and Canadian Manuscript Reports of Fisheries and Aquatic Sciences (Manuscript Reports).

Examples of existing compilation documents relevant to the study area and used in this report include:

- Ecologically and Biologically Significant Areas of the Scotian Shelf and Environs: A Compilation of Scientific Expert Opinion, DFO Technical Report highlighted on page 10 (Doherty and Horsman 2007)
- Significant Habitats Atlantic Coast Initiative, DFO Manuscript Report (McCullough *et al.* 2005 and Schaefer *et al.* 2004)
- Ecosystem Overview and Assessment Report for the Bras d'Or Lakes, DFO Manuscript Report (Parker *et al.* 2007)
- Draft Ecological Overview and Assessment Report (EOAR) for the Inshore Scotian Shelf (Bundy *et al.* 2007). This report was originally drafted in 2007 and has been a work in progress

with an expected completion date of 2011. Once complete, the EOAR will compile additional data sources that are not yet available for inclusion in this report.

- A Study to Identify Marine Natural Areas of Canadian Significance in the Scotian Shelf Marine Region, consultant report prepared for Parks Canada (Lane and Associates Ltd. 1992).

Physical characteristics and habitat information for each site were obtained from the following major sources, among others:

- *Natural History of Nova Scotia, Volume One: Topics and Habitats and Volume Two: Theme Regions* by Davis and Browne (1996a,b); broadly describes Nova Scotia's habitats and geology within nine theme regions along the Atlantic coast. See Appendix C for a map of the theme regions.
- The NSDNR Wetland Inventory. Provides habitat information at finer scales. Data were derived by the "visual interpretation and digitizing of 1:10,000 scale aerial photography flown during the late 1980s and 1990s" (NSDNR 2000).
- The CWS Maritimes Wetland Inventory (MWI) for "Nova Scotia was based primarily on colour air photos taken during 1974 to 1978 at a scale of 1:10,000. Supplemental photos used were taken during 1969, 1970 and 1973 at a scale of 1: 15,840, as well as 1: 20,000 scale photos taken during 1981" (Hanson and Calkins 1996). The WMI was used only in the sections on Bird Information but can be compared with more current information on eelgrass obtained through the NSDNR wetland inventory.
- Coastal inlets from St. Mary's Bay to Chedabucto Bay were classified by Greenlaw (2009) to "predict biological community types and α and β-diversity patterns" for a Master of Science thesis. Components of this work are expected to be published. This work involves using geophysical information to identify representative habitat types where actual biogeographic information is limited or absent (Greenlaw 2009) and aims to address the ad-hoc selection of MPAs by enabling the incorporation of representation into MPA network design in coastal Nova Scotia. The inlet classification assigned to each site (where applicable) by Greenlaw (2009) is noted in each site profile in Section 4.0 under "Physical and Oceanographic Attributes".
- Transect surveys of macroalgae conducted by Moore and Miller (1983) and Moore *et al.* (1986) were used to describe macrophytes in each area. The information in these reports has not been updated and the surveys did not cover extensive areas.
- The Coastal Resources Mapping Project conducted in collaboration between DFO, other government agencies, and coastal communities in which Traditional Ecological Knowledge was gathered through interviews with community members. The project duration was four years from 1993 to 1997 and a variety of information was collected on 1:10,000 base maps within all counties across Nova Scotia. Although the methods were not consistent across all counties, these projects provided information on habitats and species distribution where information was otherwise lacking.

Preliminary results of initiatives under the Inshore Ecosystem Project (IEP) were also presented in this report. See the boxed feature on the following page for further information.

Other sources of information include government and non-government websites and databases, journal articles (although few pertain to the identification of significant features outlined in Table 3.3), academic theses, other DFO reports (*e.g.* Canadian Science Advisory Secretariat publications), unpublished data from DFO's Science Branch and personal communications with scientists and other staff within DFO.

The Inshore Ecosystem Project (IEP)

The IEP was a joint project between DFO and the Fishermen and Scientists Research Society (FSRS) that was funded under Phase I of Canada's Oceans Action Plan (DFO 2007c). The study area of the IEP was from Cape Sable Island to Cape North, Cape Breton seaward to 12 nautical miles (DFO 2007c). There were eight research initiatives as part of this project:

1. Workshop on inshore ecosystems and significant areas of the Scotian Shelf (DFO 2006);
2. Analysis of DFO databases and data archiving;
3. Monitoring of environmental and oceanographic data;
4. Grey seal pup survey;
5. At-sea catch analysis;
6. Fishery-independent research;
7. Video of bottom habitat using URCHIN (Underwater Reconnaissance and Coastal Habitat Inventory); and
8. Local Ecological Knowledge (LEK) Survey of commercial fish harvesters.

A workshop was held on March 19-20, 2007 to begin the synthesis of the results of the eight projects and to discuss if the results could be used to further identify EBSAs (DFO 2007c). The analysis and synthesis is not complete for these projects (*Ibid.*). Some of the results for the fisheries-independent research were available at the time of writing and are discussed in the site profiles. Final results will contribute to conservation planning and integrated management in the Maritimes Region when they become available.

The fisheries-independent research was conducted in nine areas along the Atlantic coast. Two sample designs were used in each area: parallel and transect sampling. In the parallel sampling, five sites in the area were sampled by beach seine, lobster traps, bongo nets, conductivity and temperature at depth (CTD) sampling. Water sampling (for nutrient analysis: silicate, phosphate, nitrate, nitrite, and ammonia) also occurred in depths up to ~ 10 m (DFO 2007c). Transects ran perpendicular to the shore from depth of 10-15 m to 100m, and were sampled using lobster traps, multipanel gillnets, bongo nets, CTD sampling and water samples were removed for nutrient analysis (silicate, phosphate, nitrate, nitrite, and ammonia). The survey occurred during the summer, thus the potential confounding effects of the season of sampling have not yet been assessed (*Ibid.*).

4.0 Site Profiles

The following section consists of profiles of the twenty Type I and II Sites, each of which contains the following sub-sections: Site Overview, Location and Population, Physical and Oceanographic Attributes, Ecological Attributes, Human Uses, Current Protection and Research/Conservation Initiatives, and a Summary. Each section is described in detail below.

Site Overview

The site overview is a descriptive paragraph that provides a synopsis of the ecological and human information contained in the site profile, which is described in detail (with references) in the other sections of the site profile.

Location and Population

Each site has a location map. The legend for the location maps is found in Figure 4.1. Note that the boundaries of the sites (study area boundaries) are arbitrary boundaries that are based on the results of the 2006 EBSA workshop (Doherty and Horsman 2007) described in Section 3.0. In some cases the information collected extends beyond the EBSA boundaries. When this occurs it is noted in this section.

Physical and Oceanographic Attributes

The oceanographic and physical attributes are described in this section. Oceanographic descriptions include bathymetry maps and descriptions wherever possible, tidal to freshwater ratios, tidal ranges, and inlet flushing times. Physical features and habitat types are described, mainly using the *Natural History of Nova Scotia, Volume One: Topics and Habitats* and *Volume Two: Theme Regions* by Davis and Browne (1996a,b). Although little habitat information is available within the marine environment, Greenlaw's (2009) inlet classification attempts to predict marine community and habitat types. The classification assigned to each site is noted in this section (see Section 3.2 describing Greenlaw's inlet classification).

Coastal habitat maps are shown in each of the site profiles, giving a representative sample of the different habitats within each of the sites where applicable. These maps are derived from NSDNR's wetland inventory layers from 2000. The legend for these maps is found in Figure 4.2. It is important to note that these maps may not accurately represent habitat types in the sites, as this information is not current and ecosystem changes may have occurred. These layers were derived using aerial photographs which may not detect subtidal habitats such as eelgrass to their full extent as they "typically cannot penetrate turbid coastal waters past depths of about 5 m below chart datum" (Vandermeulen 2007 *In* DFO 2007c).

Ecological Attributes

The Ecological Attributes section provides information on the selection of the area as part of the 2006 EBSA workshop (see boxed feature on page 10 for further information on the 2006 EBSA workshop). The ecological information noted in Table 3.3 is described in this section. This section also provides information on birds, as described below. At the end of this section, the most important ecological attributes are summarized in a boxed feature. Ecological information was reviewed by staff in DFO's Science Branch.

Naturalness is briefly described within each site profile with qualitative values of high, medium, or low assigned to each site. Naturalness values are assigned to each site to differentiate between areas that are "pristine and characterized by native species" and "areas that are highly perturbed by anthropogenic activities and/or with high abundances of introduced or cultured species" (DFO 2004a). These values were previously assigned to most EBSAs identified during the 2006 workshop (Doherty and Horsman 2007). Type I and II sites that were not assessed for naturalness in the 2006 EBSA workshop were qualitatively evaluated for naturalness by the author.

Bird Information

Birds are recognized ecological and environmental indicators, and also are considered useful indicators of biological diversity (Bird Life International (BLI) 2009; Pereira and Cooper 2006). It is believed that conservation efforts directed toward such indicators, and the sites/habitats that host them, can lead to protection of many other species (Hutto et al. 1987; Dufrêne and Legendre 1997). As part of its wildlife monitoring programs, CWS launched the Key Marine Habitats for Migratory Birds on Eastern Canada's Atlantic Coast project. Its goal is to identify key sites, according to marine habitat type, from intertidal salt marshes, mudflats, beaches and rocky shorelines, eelgrass beds, to and including offshore areas.

It should be stated explicitly that the twenty sites outlined in this report are not the result of efforts stemming from the aforementioned CWS initiative. Rather, references to bird distribution and abundance constitute post-hoc assessment of the sites selected via the process described herein. Bird information used to characterize each candidate site is drawn both from the literature, namely existing Important Bird Area (IBA) documentation (Bird Life International 2009), and analyses of bird distribution and abundance data conducted as part of the Key Marine Habitats for Migratory Birds on Eastern Canada's Atlantic Coast project. Specifically, databases used included waterbird colony (Atlantic Region Waterbird Colony Survey), shorebird (Atlantic Canada Shorebird Survey), and waterfowl (Atlantic Region Coastal Waterfowl Survey) databases to assess sites according to their importance at the Atlantic regional scale. In the case of the latter database, waterfowl were grouped as: 1) geese (Anserinae: *e.g.*, Canada Goose and Atlantic Brant); 2) dabbling ducks (Anatini: American Black Duck, American Green-winged Teal, American Widgeon, Mallard, etc.); 3) bay ducks (Aythyini: Greater and Lesser Scaup, Ring-necked Duck, etc.); and 4) sea ducks (Mergini: Common Eider, Common Goldeneye, Long-tailed Duck, Bufflehead, Red-breasted Merganser, Harlequin Duck, Surf, Black and White-winged Scoters, etc.). These groupings were selected according to how they correspond ecologically to the following habitats: intertidal (geese and dabbling ducks), shallow protected coastal water (bay ducks) and deeper exposed coastal water (sea ducks) habitats. Information originating from analyses of the databases listed above is cited as (CWS) throughout this report.

Candidate sites presented herein are assessed individually according to the bird numbers, or proportions of identified bird populations, that they host. The IBA process follows designation criteria based on thresholds which include congregations of birds ≥10,000, 15,000, and 20,000 individuals, and/or ≥1% of a national, continental, or global population to achieve national, continental, or global significance, respectively. These terms are used to characterize relative significance of maximum bird congregations recorded at locations corresponding as best as possible to sites presented within this document. Waterfowl numbers are qualified as very low, low, high, or very high according to the quartile (25%)

grouping to which they belong on an Atlantic regional scale. Eelgrass densities were assessed using data from the CWS Maritimes Wetland Inventory (MWI) (Hanson and Calkins 1996).

Bullet contents within the "Important Marine Ecological Features" box for each site only reference species congregations falling within the top quartile of records for all of Atlantic Canada.

Human Uses

Human use information was collected using a variety of sources including compilation documents mentioned in Section 3.2. Human use information for each site includes coastal development (residential, commercial, and industrial), commercial fishing, marine plant harvesting, aquaculture, and tourism, recreation, and culture. In most cases, each human use is described within individual sub-sections where detailed descriptions are required. Future analysis of these twenty sites will require a more detailed assessment of human uses and socio-economic considerations. Important information pertaining to some of the human uses, such as methodologies for assigning quantitative values to human uses, is detailed below.

Coastal Development

Under the Coastal Development sub-section, the presence or absence of a municipal planning strategy and land use bylaw is noted. Land use bylaws are a means of legalizing municipal strategies, therefore those strategies with associated land use bylaws may be more effective. A map of provincial areas with municipal strategies and land use bylaws can be found in the Appendix D.

Commercial Fishing

Two sources of information were used to determine fisheries landing values within each site. DFO's *Scotian Shelf: An Atlas of Human Activities* was used to obtain information on fishing activity from 1999-2003 and DFO's Maritime Fisheries Information System (MARFIS) database, accessed through DFO's Virtual Data Centre (VDC), was used for more recent information (2007-2009 data). MARFIS information is cited as VDC 2009. Commercial fishing is summarized in a table for each site and in most cases includes the immediate area surrounding or adjacent to the site. Landings were qualitatively assessed as high (H), medium (M), or low (L) relative to landings in others areas in the Maritimes Region by visually comparing the landings within each site to landings in other areas within the Maritimes Region. The landings are estimates only and should not be interpreted as fact. The landings may represent the overall importance of the area in general for each fishery relative to other areas in the region, however, the landings do not indicate the importance of each fishery to individual fish harvesters. The qualitative assessment of the fisheries landings in each site was reviewed by fisheries advisors in DFO's Fisheries and Aquaculture Management Branch.

Groundfish refers to cod, haddock, pollock, silver hake, redfish, flatfishes (*e.g.* yellowtail, witch, and winter flounders, and American plaice) and lesser known species (cusk, skate, monkfish, and sculpin), as defined in *The Scotian Shelf: An Atlas of Human Activities* (DFO 2005a).

Lobster catch and effort information is not available on a fine enough scale to determine landings in the immediate study areas. Annual lobster landings from 2008 are estimated for each site using ten minute grid squares, which are the finest-scale units to report lobster landings. The grid squares more accurately align with the study areas than other larger reporting units such as Statistical Districts and Lobster Fishing Areas (LFAs). Although the grid squares present lobster landings at a finer scale, these landings should be considered estimates only. The grid squares do not align exactly with the study areas and one year of data does not give indication of trends in lobster landings. Data from 2008 was the only data used due to difficulty in obtaining complete 2009 data prior to publication of this report and because data prior to 2008 is not complete. Prior to 2008, reporting levels within the grid squares were very low compared to traditional reporting in larger LFAs. Qualitative landing values (High, Medium, and Low) are determined based on comparisons with landings in other areas in the Maritimes Region.

Marine Plant Harvesting

Management of marine plant harvesting in Nova Scotia differs from management of other commercial fisheries in that the management is shared by the federal and provincial governments. For example, although federally marine plant harvesting is an open-access fishery such that marine plants could be harvested by anyone with a DFO-issued license (DFO 1998) and license conditions, the province of Nova Scotia also regulates the harvesting of the main commercial marine species, rockweed). Nova Scotia's Department of Fisheries and Aquaculture is the responsible authority for leasing areas of the foreshore to permit holders to enable the harvest of rockweed, setting out the duration of the permit and the harvest and reporting conditions they must follow.

Management measures include: the required use of specific gear to allow the least harm to the holdfast system so as to enable re-growth of the plant; closed times for harvesting; and maximum exploitation rates relative to biomass estimates (Rock Weed Harvesting Regulations made under Section 71 of the *Fisheries and Coastal Resources Act 1996*). Management measures may vary among different species. Rock Weed Harvesting Regulations enable the designation of closed areas by the Nova Scotia Minister of Fisheries and Aquaculture, however, there are currently no closures.

Species such as Irish moss, kelp, horsetail, and fucus require a DFO license and species specific license conditions.

Aquaculture

Figures of aquaculture sites are included in the site profiles where applicable. Aquaculture sites are referred to as licenses as per Service Nova Scotia's website, "Aquaculture Sites of Nova Scotia" (Service Nova Scotia 2008). Licenses and leases may be used synonymously in this report, as license holders must obtain both a license and a lease for the area in which they seek to conduct an aquaculture operation. Information on current activity within each lease area is not available. It can be assumed that if sampling took place through the Environmental Monitoring Program (EMP) of Nova Scotia Fisheries and Aquaculture, the aquaculture lease area or site is in operation. The EMP summary report states "All sites currently in production are tested and those with larger production are given higher priority" (NSDFA 2006).

Current Protection and Research/Conservation Initiatives

Currently designated protected areas in each site are listed and described. Most protected areas are provincial, but there are also a few federal protected areas including Migratory Bird Sanctuaries (MBSs), National Wildlife Areas (NWAs), and National Parks. Areas protected by non-government organizations such as the Nature Conservancy of Canada (NCC), Eastern Habitat Joint Venture (EHJV), and Nova Scotia Nature Trust (NSNT), are also noted. Current research and conservation initiatives are described and the availability of information for each site is noted.

Summary

The Summary section at the end of each site profile aims to summarize all important ecological and human use information and Current Protection and Research Initiatives. The summary compares the ecological attributes with *Oceans Act* criteria for MPA designations under section 35 (1).

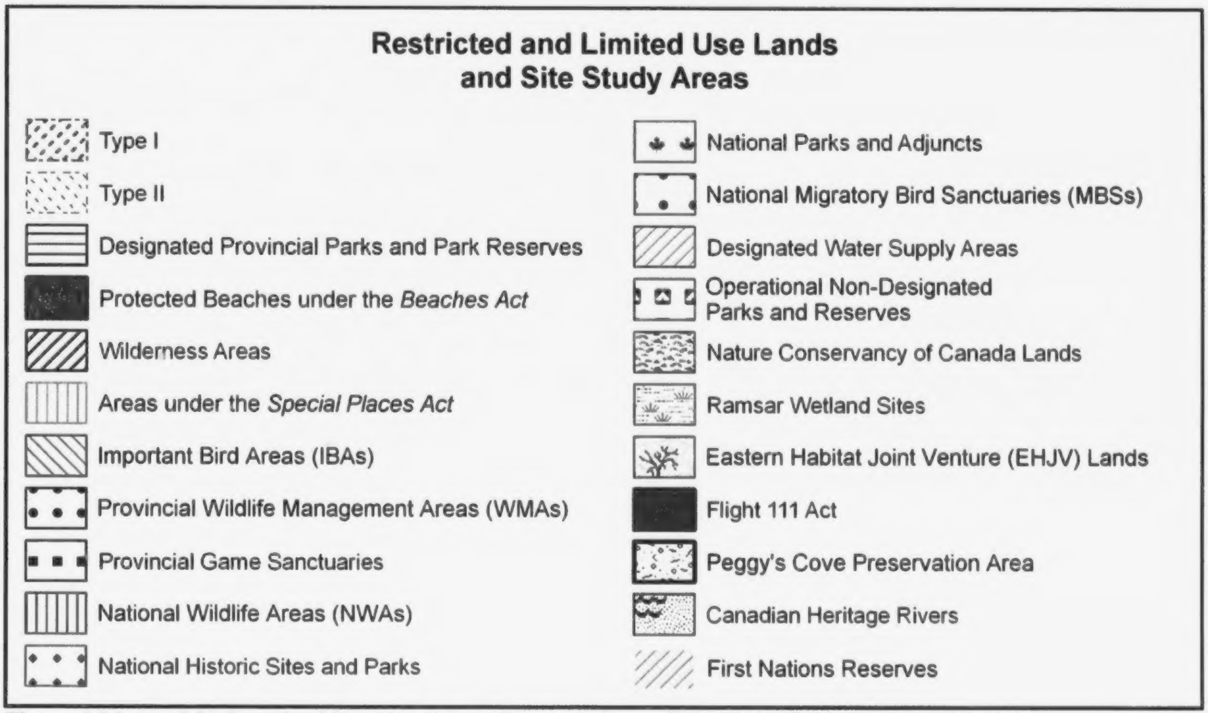

Restricted and Limited Use Lands
and Site Study Areas
Type I
Type II
Designated Provincial Parks and Park Reserves
Protected Beaches under the Beaches Act
Wilderness Areas
Areas under the Special Places Act
Important Bird Areas (IBAs)
Provincial Wildlife Management Areas (WMAs)
Provincial Game Sanctuaries
National Wildlife Areas (NWAs)
National Historic Sites and Parks
National Parks and Adjuncts
National Migratory Bird Sanctuaries (MBSs)
Designated Water Supply Areas
Operational Non-Designated Parks and Reserves
Nature Conservancy of Canada Lands
Ramsar Wetland Sites
Eastern Habitat Joint Venture (EHJV) Lands
Flight 111 Act
Peggy's Cove Preservation Area
Canadian Heritage Rivers
First Nations Reserves

Figure 4.1 Legend for Location Maps. Applies to all twenty site profiles. (NSDNR 2006b).

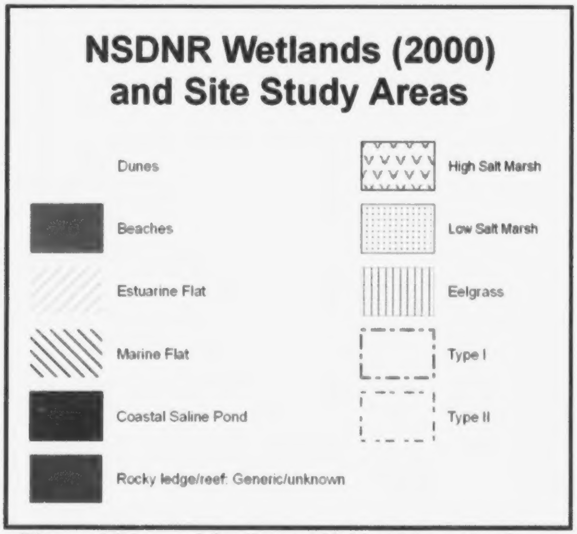

NSDNR Wetlands (2000)
and Site Study Areas
Dunes
Beaches
Estuarine Flat
Marine Flat
Coastal Saline Pond
Rocky ledge/reef: Generic/unknown
High Salt Marsh
Low Salt Marsh
Eelgrass
Type I
Type II

Figure 4.2 Legend for Coastal Habitat Maps. Applies to all twenty site profiles. (NSDNR 2000).

4.1 Lobster Bay

Lobster Bay is well known for having some of the most productive lobster fishing grounds in the province, with strong cultural ties to the fishing industry. Lobster Bay is situated in a zone of intense localized upwelling, where nutrient-rich waters create a highly productive environment where marine plants are abundant and other marine species are both abundant and diverse. The numerous elongated islands create calm inshore conditions that are optimal for salt marshes and eelgrass beds.

Location and Population

Lobster Bay is the southernmost bay in Nova Scotia and is located in Yarmouth County. The study area comprises the entire bay from Big Tusket Island to Pubnico Point and is approximately 277.6 km^2. Some of the islands outside of the area are included in the site description. See Figure 4.4 for the location map of Lobster Bay. There are several towns in the area including Wedgeport on the west side of the bay and Pubnico on the east which are both well known fishing communities. The area has an average population density of 20-140 people per km^2 with a significantly higher density at Wedgeport (Municipal Services 2001). The area is experiencing population decline (Service Nova Scotia and Municipal Relations 2006).

Physical and Oceanographic Attributes

Lobster Bay is one of the largest bays in Nova Scotia with a total area of 137.9 km^2 including intertidal areas, as delineated by DFO (2007b). The bay contains numerous islands and is bathymetrically complex. The bay has been classified as a complex mixed bay (Greenlaw 2009) and is tidally dominated with a tidal to freshwater ratio of 2172.9:1 and a high flushing time of 22.6 hours (DFO 2007d). There are numerous lakes and streams connecting to the bay; the watershed drainage area is 283.8 km^2 (*Ibid.*). The Bay is shallow near the coast with depths ranging from 5 – 10 m becoming deeper south of Lower West Pubnico. The inner bay (landward of Upper West Pubnico) is quite shallow overall with a maximum depth of approximately 30 m (see Figure 4.3, DFO 2007d).

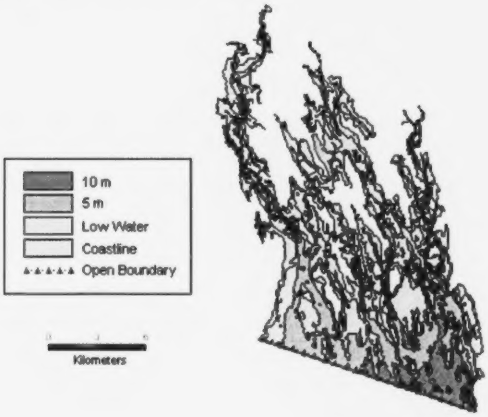


Figure 4.3 Lobster Bay Bathymetry (DFO 2007d)
Coastline = intertidal zone

Lobster Bay is characterized by a submerged coastline with long promontories and inlets with abundant sediment supplies from glacial deposits enabling the development of extensive salt marshes which line much of the coastline (Davis and Browne 1996b). Other coastal features such as estuarine flats are shown in Figure 4.5. The milder temperatures enable the survival of relict coastal plain flora species and the localized upwelling drives the productivity for a diversity of marine species. Many of the islands and surrounding landscape are drumlin formations and others are Liverpool soils which are poorly drained, causing the formation of several large peat areas along the coast (*Ibid.*).

Although the area has cold upwelling currents, the innermost portion of the bay provides shelter causing warmer temperatures and creating optimal conditions for invertebrates. Further from shore, oceanographic upwelling brings abundant nutrients and creates an optimal environment for several marine species including large pelagics (*Ibid.*). The tidal range in Lobster Bay is 3.51-5 m which is at least twice as high as most areas along the Atlantic coast of Nova Scotia (Greenlaw 2009; Tremblay and Smith 2001).

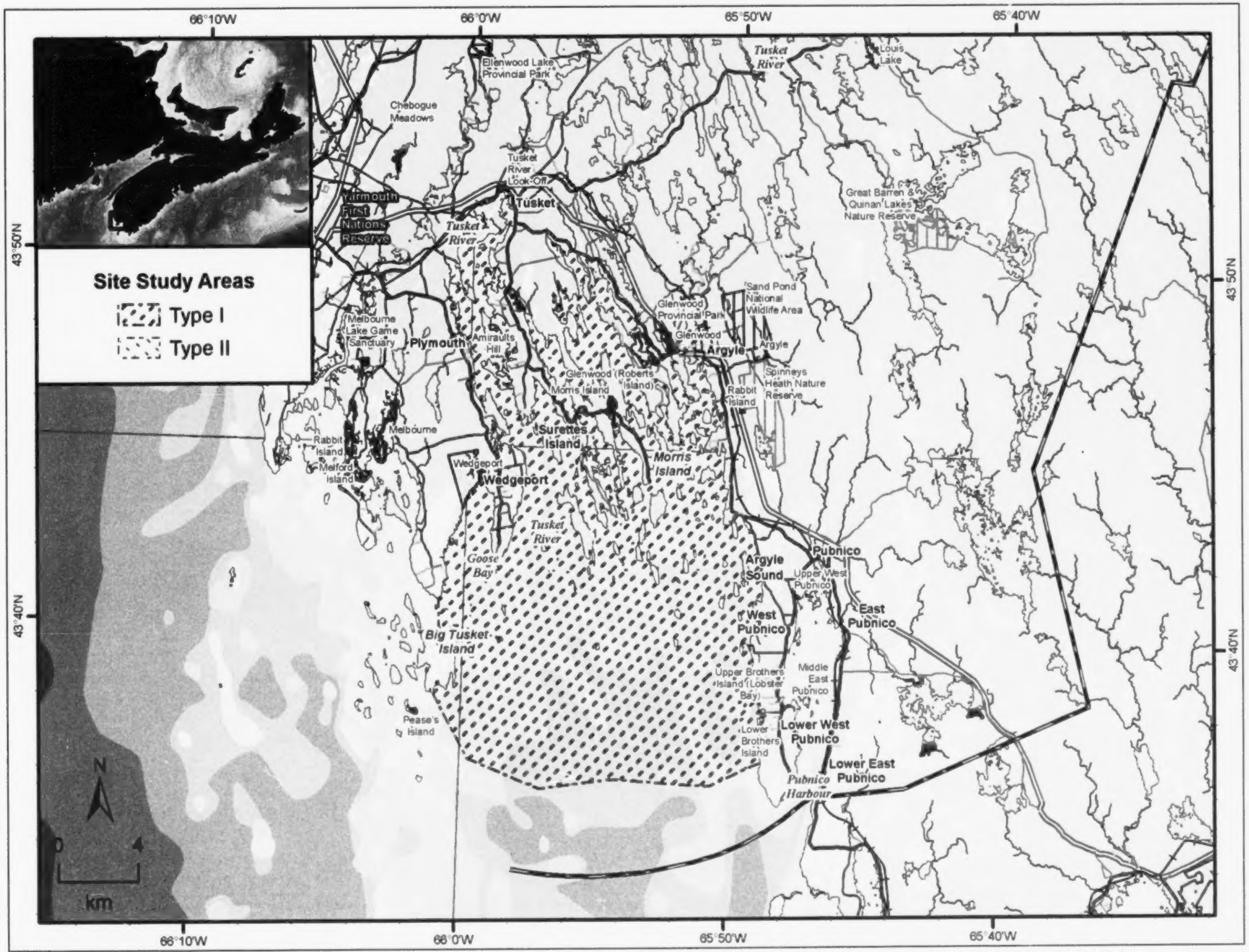

66°10'W
66°0'W
65°50'W
65°40'W
43°50'N
43°40'N
Site Study Areas
Type I
Type II
Ellenwood Lake Provincial Park
Chebogue Meadows
Tusket River
Louis Lake
Tusket River Look-Off
Tusket
Yarmouth First Nations Reserve
Great Barren & Quinan Lakes Nature Reserve
Sand Pond National Wildlife Area
Glenwood Provincial Park
Glenwood
Argyle
Melbourne Lake Game Sanctuary
Plymouth
Amiraults Hill
Glenwood (Roberts Island)
Morris Island
Spinneys Heath Nature Reserve
Rabbit Island
Melbourne
Surettes Island
Melford Island
Wedgeport
Tusket River
Goose Bay
Argyle Sound
Pubnico
Upper West Pubnico
East Pubnico
West Pubnico
Big Tusket Island
Upper Brothers Island (Lobster Bay)
Middle East Pubnico
Pease's Island
Lower Brothers Island
Lower West Pubnico
Lower East Pubnico
Pubnico Harbour
N
0
4
km

Figure 4.4 Location Map for Lobster Bay (Site #1). Basemap layers: land 1: 50 000, 1: 250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); Restricted and Limited Use Land Database Layers (NSDNR 2006b). Refer to Figure 4.1 for legend.

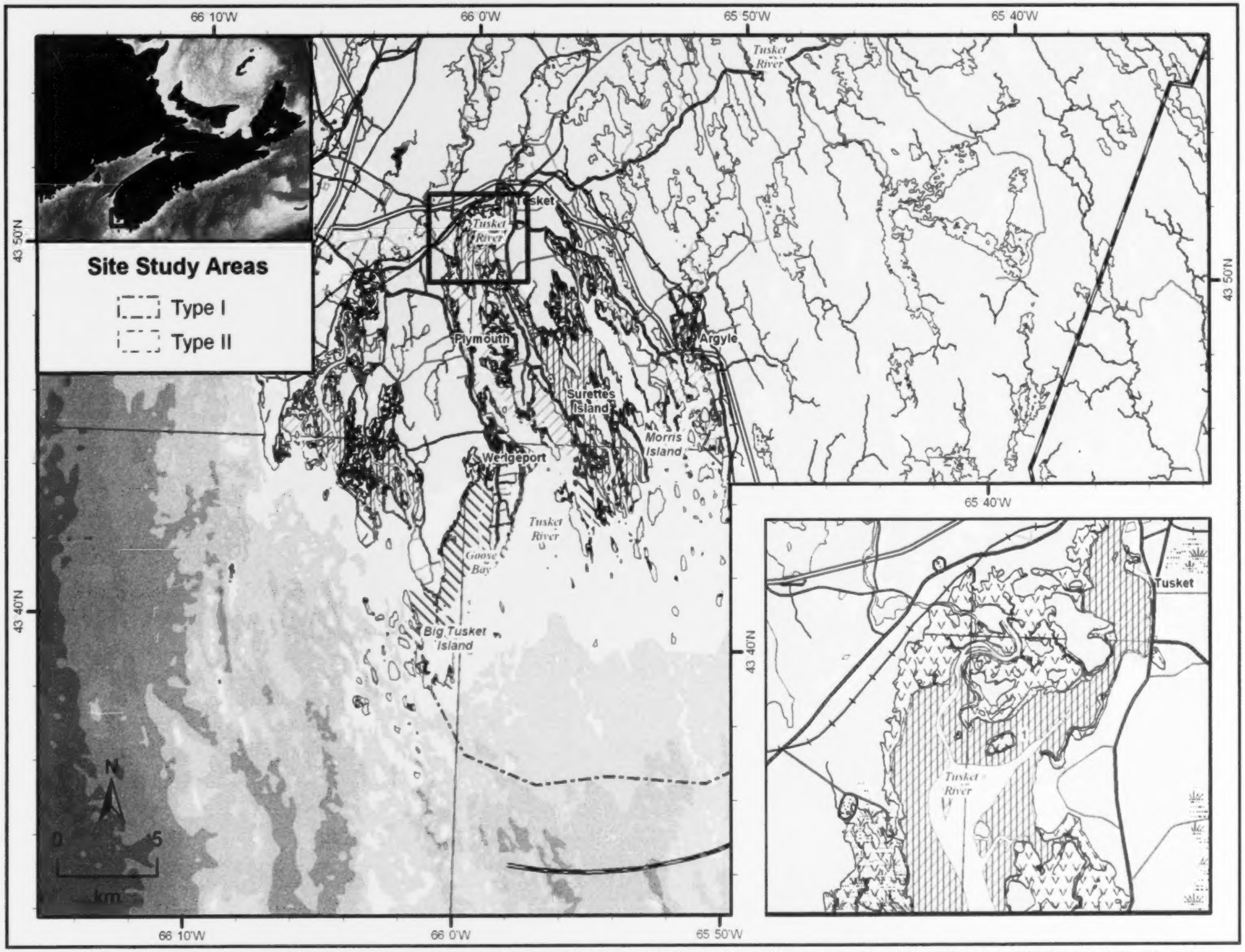

66 10'W
66 0'W
65 50'W
65 40'W
43 50'N
43 40'N
Tusket River
Tusket
Plymouth
Argyle
Surettes Island
Morris Island
Wedgeport
Tusket River
Goose Bay
Big Tusket Island
Site Study Areas
Type I
Type II
N
0
5
km
65 40'W
43 40'N
Tusket
Tusket River

Figure 4.5 Coastal Habitats in Lobster Bay. Basemap layers: land 1:50 000, 1:250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); NSDNR Wetlands Database layers (NSDNR 2000). Refer to Figure 4.2 for legend.

Ecological Attributes

Lobster Bay was identified by scientific experts as an ecologically and biologically significant area (EBSA). It was the only area identified that meets all of the EBSA criteria to a high degree, and was one of four areas identified five times by scientific experts (Doherty and Horsman 2007). By comparison many other areas were identified only once or twice.

Lobster Bay is well-known as a unique area of Nova Scotia for its importance for lobster and for localized upwelling, which creates a highly productive marine environment year-round (Tee and Smith 1993). The nutrient-rich waters at the mouth of the bay brought about by coastal upwelling, coupled with the sheltering effect of the islands causing warmer temperatures closer to the coast give the area a diversity of species and habitats unlike other areas of Nova Scotia (Davis and Browne 1996b).

Lobster Bay is one of only four active herring spawning areas within the study area of this report and one of only seven areas when the Bay of Fundy is included (DFO 2008a). The area supports aggregations of lobster, multiple groundfish species, large schools of spiny dogfish, one of the largest grey seal colonies on the Atlantic coast of Nova Scotia, butterfish, Atlantic cod, skates, and winter flounder (Hudon 1994; Doherty and Horsman 2007; Simon and Campana 1987; Lidgard 2007 *In* DFO 2007c). Southwest Nova Scotia is the most productive area for lobster in coastal Nova Scotia (Tremblay *et al.* 2009), despite an unusual bottom type composed of mud (Doherty and Horsman 2007; Hudon 1994).

There are two species in the area listed under SARA: a population of Atlantic wolffish (special concern, SARA) (Doherty and Horsman 2007) and Roseate Terns (endangered, SARA) found in the Brothers Islands WMA (NSDNR 2009a). COSEWIC-listed species found in the area are Atlantic cod and spiny dogfish which were recently assessed as endangered and special concern, respectively (COSEWIC 2010). The Tusket River which drains into Lobster Bay once supported a population of endangered (SARA) Atlantic whitefish, but the species has since been extirpated (DFO 2008a). Fin whales (special concern, SARA) are occasionally seen offshore from the study area (Lane and Associates 1992).

The numerous elongated islands provide shelter in the inner bay. Coupled with a high supply of sediment, this creates an optimal environment for the numerous and extensive salt marshes that line much of the coastline (Davis and Browne 1996b; NSDNR 2000; Hudon 1994). Extensive eelgrass beds are present throughout the bay, however some areas have experienced declines of up to 44% from 1978-2000 (Sharp *et al.* 2007 *In* DFO 2007c).

A strong indicator of the high productivity of Lobster Bay is the abundant kelp that grows twice as fast here compared to the rest of Nova Scotia (Doherty and Horsman 2007). Marine plants provide several valuable ecosystem functions including nutrient recycling, sediment stabilization and habitat for several species throughout different life cycle stages (Heck *et al.* 2003). The highest kelp biomass is found in semi-exposed and exposed areas between 0 and 5 metres deep (Sharp and Carter 1986). The Cape Sable to Yarmouth area has had the most stable marine plant communities from the 1940s to the present. There have not been any sea urchin outbreaks or grazing fronts in the area (G. Sharp, DFO Science Branch, pers. comm. 2009). The area also has the most extensive rockweed (*Ascophyllum nodosum*) in Nova Scotia, which is intensely harvested (DFO 1998).

The level of naturalness in the area is difficult to determine. There is intense lobster fishing, rockweed harvesting, and some shellfish and finfish aquaculture, however, the high tidal energy of the bay and quick flushing time may result in a more resilient ecosystem to some human impacts (further discussed in the following section).

Bird Information

Although Lobster Bay does not coincide or otherwise overlap with presently identified IBAs, the Brothers Islands located within the bay, will soon be identified as a new IBA (Number NS003). These islands host nationally significant numbers of Roseate Tern (endangered, SARA; CWS), and meet fundamental IBA designation criteria. Also, large numbers of breeding Common Tern, Arctic Tern, Herring Gull, Great Black-backed Gull, Great Blue Heron and Double-crested Cormorant, as well as Leach's Storm-petrel, nest in the area (CWS). The Goose Bay, Wedgeport and Argyle areas in the northern inner bays especially, as well as western parts of Lobster Bay can host very high numbers of migrating and wintering geese and dabbling ducks (CWS), potentially as a function of very high eelgrass densities in those areas (Hanson and Calkins 1996). Goldeneye, scaup and other bay ducks use the northeastern and southwestern parts of the bay in high to very high numbers. Low to high numbers of sea ducks, including eiders and scoters also frequent these parts of the bay (CWS).

Important Marine Ecological Features:

- Highly productive environment with extreme tidal mixing causing localized upwelling
- Very important lobster area with unusual lobster habitat
- Diversity of habitats and species
- Herring spawning area
- Other species aggregations: groundfish, butterfish, Atlantic cod, skates, and winter flounder; large aggregations of spiny dogfish
- Extensive eelgrass and salt marshes
- Kelp grows twice as fast as in other areas of Nova Scotia
- SARA-listed species: Atlantic wolffish (special concern) and Roseate Tern (endangered)
- COSEWIC-assessed species: Atlantic cod (endangered) and spiny dogfish (special concern)
- Birds: IBA (1), species at risk, colonies, eelgrass habitat, geese, dabbling ducks, bay ducks.

Human Uses

Human uses in Lobster Bay include coastal development, commercial fishing, marine plant harvesting, aquaculture, and some tourism.

Coastal Development

With an average but declining population density, new residential development is not perceived as a major issue in the area. Municipalities surrounding the study area have comprehensive municipal planning strategies and land use bylaws (see Appendix D) (CBCL Limited 2009). At the time of writing, there was a substantial harbour development scheduled for Lower East Pubnico, Belliveau Shipyard (CEAA 2010). The project involves the construction of breakwaters and other shoreline protection, wharves and a launching facility, and harbour basin dredging (*Ibid.*). This project is located outside the study area, however, it could affect Lobster Bay. The Environmental assessment was completed and the authorities are of the opinion that the project will not likely cause significant adverse environmental effects (*Ibid.*). The area may have potential for wind energy development, with high wind speeds of 8.01-9.5 m/s on adjacent land surrounding the entire study area (Province of Nova Scotia 2010).

Commercial Fishing

The lobster fishery of Lobster Bay is extremely important. Lobster Bay and the surrounding area has the highest concentration of lobster harvesters in Nova Scotia with 970 licenses in Lobster Fishing Area (LFA) 34 of 3400 province wide (28.5% of licenses in Nova Scotia) (NSDFA 2007a). Yarmouth, Pubnico, Cape Sable and LaHave have the highest landed value for all species in Nova Scotia, making up 5% of total provincial landed values from 1991-2001 (CCN 2006). There are approximately five fish processing plants and six boatbuilding facilities around Lobster Bay, as well as numerous government wharves and Small Craft Harbours (CCN 2006).

LFA 34 has lobster grounds that are among the most productive in the world with landings in recent years exceeding 13,000 metric tonnes (MT) which account for 40% of Canada's landings and 23% of global landings (VDC 2009; DFO 2005a; Pezzack *et al.* 2006; Pezzack *et al.* 2001). LFA 34 comprises 61% of 2008 landings in DFO's Maritimes Region. In grid squares 127 and 140, the reporting units that most closely align with the study area, 2008 lobster landings are estimated at 1272 MT. These landings comprise 4.27% of 2008 landings in the Maritimes Region and 7.02% of LFA 34 landings in 2008. Landings in this area and in the Cape Sable Island area are significantly higher than other sites in this analysis (VDC 2009).

Although lobster is the primary fishery in the area, there are groundfish landings, which are minimal on a provincial scale, and there is also mackerel fishing with trap nets in the Little River Harbour area south of Pubnico Point (DFO 2005a) and near Pubnico Point (VDC 2009). Both of these areas are adjacent to the study area but landings are high compared to other areas in the Maritimes Region. There has been anecdotal information of unauthorized scallop dragging inshore within Lobster Bay (M. Butler, Fisheries and Aquaculture Management Branch, pers. comm. 2010).

There is also a seal hunt occurring in the area. At least 65 seal pups were taken in 2007 from Noddy Island (Lidgard 2007 *In* DFO 2007c). An exploratory mussel fishery took place in Lobster Bay in 1988 with one license issued (Sharp *et al.* 1989). Table 4.1 below summarizes the major commercial fisheries and notes gear used.

Table 4.1 Summary of Major Commercial Fisheries and Gear Used in and Adjacent to Lobster Bay

Species	Landings*	Gear	Year	Source
Lobster	H	Trap	2008	VDC 2009
Groundfish	L	Bottom longline (primarily), otter trawl	1999-2003, 2007-2009	DFO 2005a VDC 2009
Mackerel	H	Gill net, trap net	1999-2003, 2007-2009	DFO 2005a VDC 2009
Seals	N/A	N/A	2007	Lidgard 2007 *In* DFO 2007c

*H = high, M = medium, L = low

Marine Plant Harvesting

Most marine plant harvesting in Nova Scotia occurs in Lobster Bay and has occurred there since the 1940's, with rockweed having the highest landings (Sharp *et al.* 2008). Very little kelp (Laminaria spp.) harvesting has occurred in the area since the 1940's (Bundy *et al.* 2007). Rockweed harvesting makes up 67.8-88% of landings in Nova Scotia and harvests have exceeded 20,000 tonnes since 1986 (DFO 1998).

There was once a high degree of instability of boundaries between provincially leased areas and areas open to unlimited rockweed harvesting due to frequent reassigning of leased areas to different companies (DFO 1998). This resulted in crossing between leases and illegal harvesting (*Ibid.*). The boundaries are now somewhat stable with two companies operating in the bay (*Ibid.*). Zones that were previously open to unlimited harvesting have been eliminated (*Ibid.*). In 1998 it was assumed that rockweed was being overexploited in the bay (*Ibid.*). There are no published stock status reports beyond 1998 for rockweed, but presently there is a sustained annual harvest with no signs of overexploitation (G. Sharp, DFO Science Branch, pers. comm. 2009).

In recent years, approximately 200-300 licenses were issued annually for the harvest of Irish moss, although not all were utilized (V. Bradshaw, DFO Fisheries and Aquaculture Management Branch, pers. comm. 2010). There have been major changes in Irish moss stands which have gone from homogeneous and more easily harvested stands to stands with a diversity of species, resulting in the exploration of areas further east along Nova Scotia's coast for harvesting potential (Sharp *et al.* 2008).

Aquaculture

There are 19 aquaculture licenses in the area and five in adjacent areas, making up a total lease area of 102.78 ha and 114.70 ha respectively (see Figure 4.6, Service Nova Scotia 2008). The adjacent areas include Pubnico Harbour and Goose Bay near Wedgeport (Service Nova Scotia 2008). Aquaculture makes up 0.37 % of the total study area. There are rainbow trout licenses to the west of Upper West Pubnico which were sampled as part of the Environmental Monitoring Program (EMP) (NSDFA 2006). Inner Lobster Bay and Goose Bay only contain shellfish operations and Pubnico Harbour has three finfish licenses and three shellfish licenses (Service Nova Scotia 2008). Lobster Bay has the second highest number of licenses of the twenty areas in this report with Mahone Bay having the most licenses.

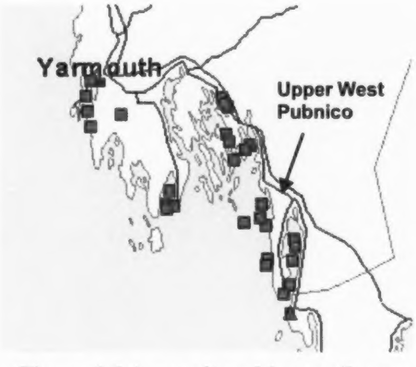


Figure 4.6 Aquaculture Licenses/Leases in Lobster Bay (denoted by green squares) (Service Nova Scotia 2008)

Tourism, Recreation, and Culture

Tourism is also part of the economy surrounding Lobster Bay, but the area is not a well-known tourist destination in Nova Scotia. Tourists often come from the US when the ferry from Maine docks in nearby Yarmouth with tourists usually on route to Halifax. The area has a few public wharves at Ledge Harbour, Abbotts Harbour, Camp Cove, Sluice Point, Lower Wedgeport, Pinkney's Point, and Little River. There are sea kayak rentals at West Pubnico (Adventure Nova Scotia 2009). The entire coastal area has Acadian settlements which are some of the oldest and continually occupied settlements in the province (Lane and Associates 1992). The area has tourist attractions including museums, the "Village historique acadien" and an 18-hole golf course (Destination Southwest Nova Scotia Association 2006).

Current Protection and Research/Conservation Initiatives

There is some adjacent terrestrial protection in the area which could complement marine conservation measures. The Brothers Islands WMA protects endangered Roseate Terns and their nesting habitat. It is located near Lower West Pubnico and contains a marine component (NSDNR 2009a). Other protected areas are not located directly adjacent to the coast but are likely connected by the numerous streams and rivers. These areas include Sand Pond NWA, three EHJV Lands, Spinney's Heath Nature Reserve, and Glenwood Provincial Park (NSDNR 2006b).

Lobster Bay is recognized as an ecologically important area by other federal and provincial departments. Lobster Bay was one of the four areas with the highest level of interest for conservation within CPANS. The inner bay contains rare coastal flora and important headlands that are of conservation interest. There is interest in the protection of Seal Island and Mud Islands and in increased protection of the Brothers Islands and surrounding waters for the endangered Roseate Tern, although these islands are outside the study area boundaries.

Systematic research of the marine environment is limited to a trawl survey conducted in the 1980s (Simon and Campana 1987). NSDNR Wildlife Division is conducting research on coastal plains flora and there has also been extensive research on marine plants, lobsters for stock assessments, and oceanographic processes. Otherwise, the area lacks sufficient information on ecosystem attributes and could benefit from habitat mapping and research on juvenile assemblages, given the known abundance of eelgrass, kelp, and rockweed. The area is outside of the IEP study area and the Inshore Scotian Shelf EOAR, and therefore may have less current information available than others sites within the scope of this report (Bundy 2007).

Summary

Table 4.2 below summarizes the key information provided in the site profile. Lobster Bay is a highly productive environment with many important ecological attributes that are recognized by other federal and provincial government departments. The ecological attributes align with all of the *Oceans Act* criteria for MPA establishment.

Table 4.2 Summary of Lobster Bay site profile

***Oceans Act* Criteria (s.35)**	**Ecological Attributes**	**Human Uses**	**Current Protection and Research Initiatives**
(a) The conservation and protection of commercial and non-commercial fishery resources, including marine mammals, and their habitats; (b) The conservation and protection of endangered or threatened marine species, and their habitats (c) The conservation and protection of unique habitats; (d) The conservation and protection of marine areas of high biodiversity or biological productivity	• Highly productive environment with extreme tidal mixing causing localized upwelling • Very important lobster area with unusual lobster habitat • Diversity of habitats and species • Herring spawning area • Numerous species aggregations: groundfish, butterfish, Atlantic cod, skates, winter flounder; and large aggregations of spiny dogfish • Extensive eelgrass beds and salt marshes • Kelp grows twice as fast as in other areas of Nova Scotia • SARA species: Atlantic wolffish and Roseate Tern • COSEWIC species: Atlantic cod and spiny dogfish • Birds: newly-designated IBA, eelgrass habitat, colonies, geese, dabbling ducks, bay ducks	• Moderate coastal development including proposed harbour development in Lower East Pubnico • Fishing - lobster - groundfish - mackerel - seals • Rockweed and Irish moss harvesting • Aquaculture: finfish and shellfish • Tourism and recreation	• Recognized conservation importance among other federal and provincial departments • Limited terrestrial protection • No recent survey or habitat data

4.2 Cape Sable Island

Cape Sable Island is well known as one of the most productive lobster fishing areas in Nova Scotia. The eastern half of the island is an IBA, drawing bird watchers in the summer months. The area is best known for hosting nationally significant numbers of endangered Piping Plovers during the summer breeding season. The area is oceanographically unique with a high degree of localized upwelling resulting in a highly productive marine environment, particularly for lobster.

Location and Population

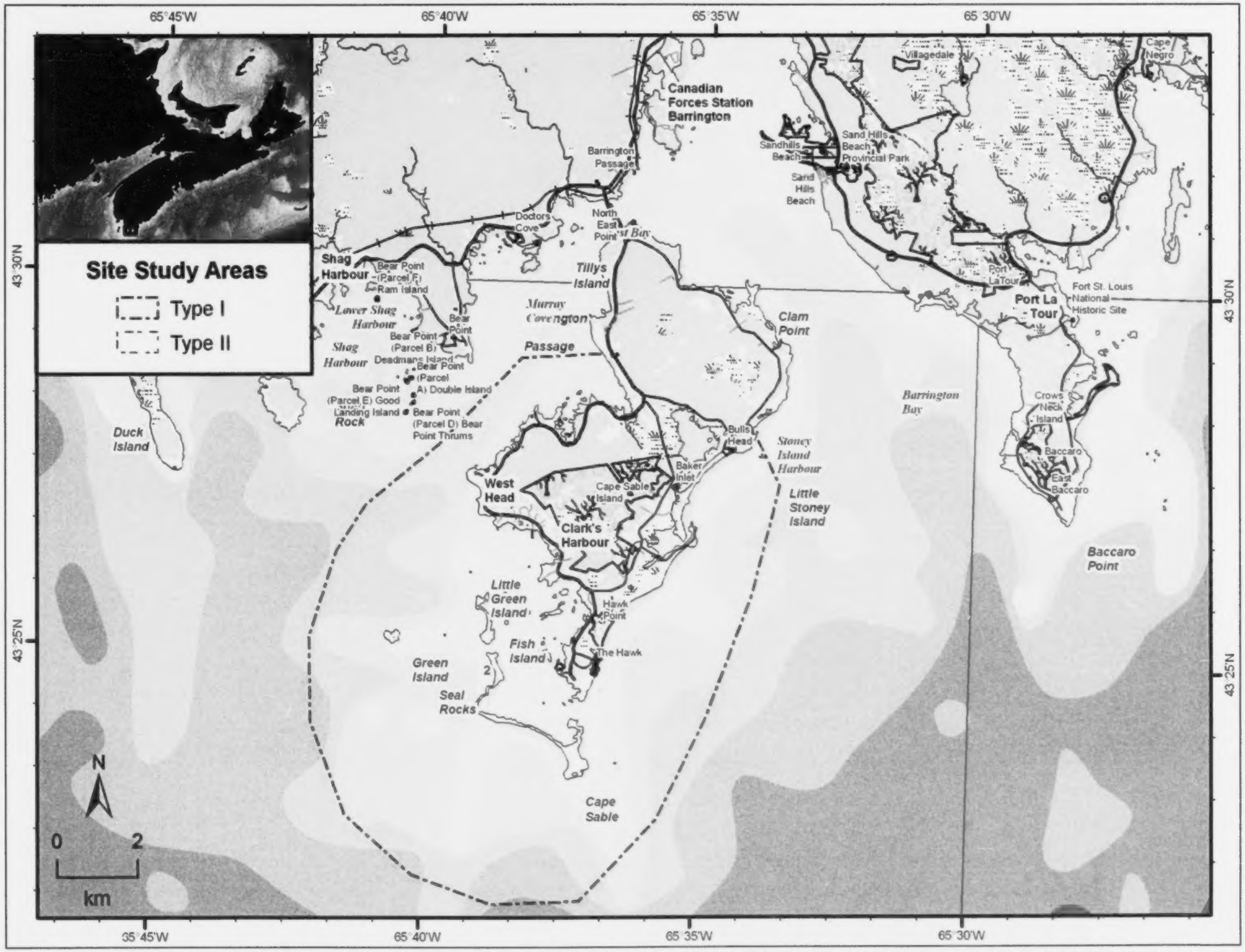
Cape Sable Island is located on the south shore of Nova Scotia in Shelburne County. The study area encompasses the southern half of the island (including the waters of Clark's Harbour) and is approximately 88.3 km^2. Due to proximity and ecosystem connectivity the northern half of the island and surrounding water bodies (Barrington Bay and Barrington Passage) are also included in this compilation. See the Cape Sable Island location map (Figure 4.7).

Clark's Harbour is the largest community on the island with a population of 860. The entire island has a population of 3,359. The island is connected to the mainland by a causeway at Barrington Passage (Service Nova Scotia and Municipal Relations 2006). The area has a medium population density of 20-140 people per km^2 with a significantly higher density at Clark's Harbour (Municipal Services 2001). The area is experiencing population decline (Service Nova Scotia and Municipal Relations 2006).

Physical and Oceanographic Attributes

Cape Sable Island has an area of approximately 40 km^2 (Chiasson *et al.* 2001). The area represents the turning point between the strong tidal currents of the Bay of Fundy and the smaller tidal range that occurs along the Atlantic Coast. As a result, the general area is tidally dominated with little freshwater input and high flushing times. Barrington Passage has been classified as a complex mixed bay (Greenlaw 2009) that is approximately 15.2 km^2 with a maximum depth of 14.9 m and a high flushing time of 18.0 hours (DFO 2007d). Barrington Bay was classified as an intermediate mixed bay, one of only three identified on the Atlantic coast of mainland Nova Scotia (Greenlaw 2009). It has an area of 40.1 km^2 with a maximum depth of 15.0 m and a flushing time of 35.7 hours (DFO 2007d). The marine environment around Clark's Harbour is predominately intertidal, with a very high tidal to freshwater volume ratio of 1675.9:1 (*Ibid.*). Barrington Bay, Barrington Passage, and Clark's Harbour have watershed drainage areas of 341.5 km^2, 56.2 km^2, and 15.4 km^2, respectively (*Ibid.*).

The physical features of the area are common features of most of the south shore, from Lower Woods Harbour to Medway Harbour (Davis and Brown 1996b). The area experiences higher temperatures than the rest of the Atlantic coast (*Ibid.*). The dominant bedrock is greywacke with granite intrusions and the terrain has very little relief but an indented coastline with long narrow inlets that are drowned river estuaries. There are very few glacial deposits. The coast is a high energy wave environment and consists of dunes, flat sand beaches, and tidal marshes (*Ibid.*). Coastal features are shown in Figure 4.8 below. The area is highly sensitive to sea-level rise (NRCan 2007).


65°45'W
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65°30'W
43°30'N
43°25'N
Site Study Areas
Type I
Type II
Canadian Forces Station Barrington
Villagedale
Cape Negro
Barrington Passage
Sandhills Beach
Sand Hills Beach Provincial Park
Sand Hills Beach
Doctors Cove
North East Point
Shag Harbour
Bear Point (Parcel F)
Ram Island
Lower Shag Harbour
Bear Point
Bear Point (Parcel B)
Shag Harbour
Deadmans Island
Bear Point (Parcel A) Double Island
Bear Point (Parcel E) Good
Landing Island
Rock
Bear Point (Parcel D) Bear Point Thrums
Tillys Island
Murray Covengton
Passage
Clam Point
Port LaTour
Port La Tour
Fort St. Louis National Historic Site
Barrington Bay
Crows Neck Island
Baccaro
East Baccaro
Duck Island
Bulls Head
Stoney Island Harbour
Little Stoney Island
Baker Inlet
West Head
Cape Sable Island
Clark's Harbour
Baccaro Point
Little Green Island
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Figure 4.7 Location Map for Cape Sable Island (Site #2). Basemap layers: land 1: 50 000, 1: 250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); Restricted and Limited Use Land Database Layers (NSDNR 2006b). Refer to Figure 4.1 for legend.

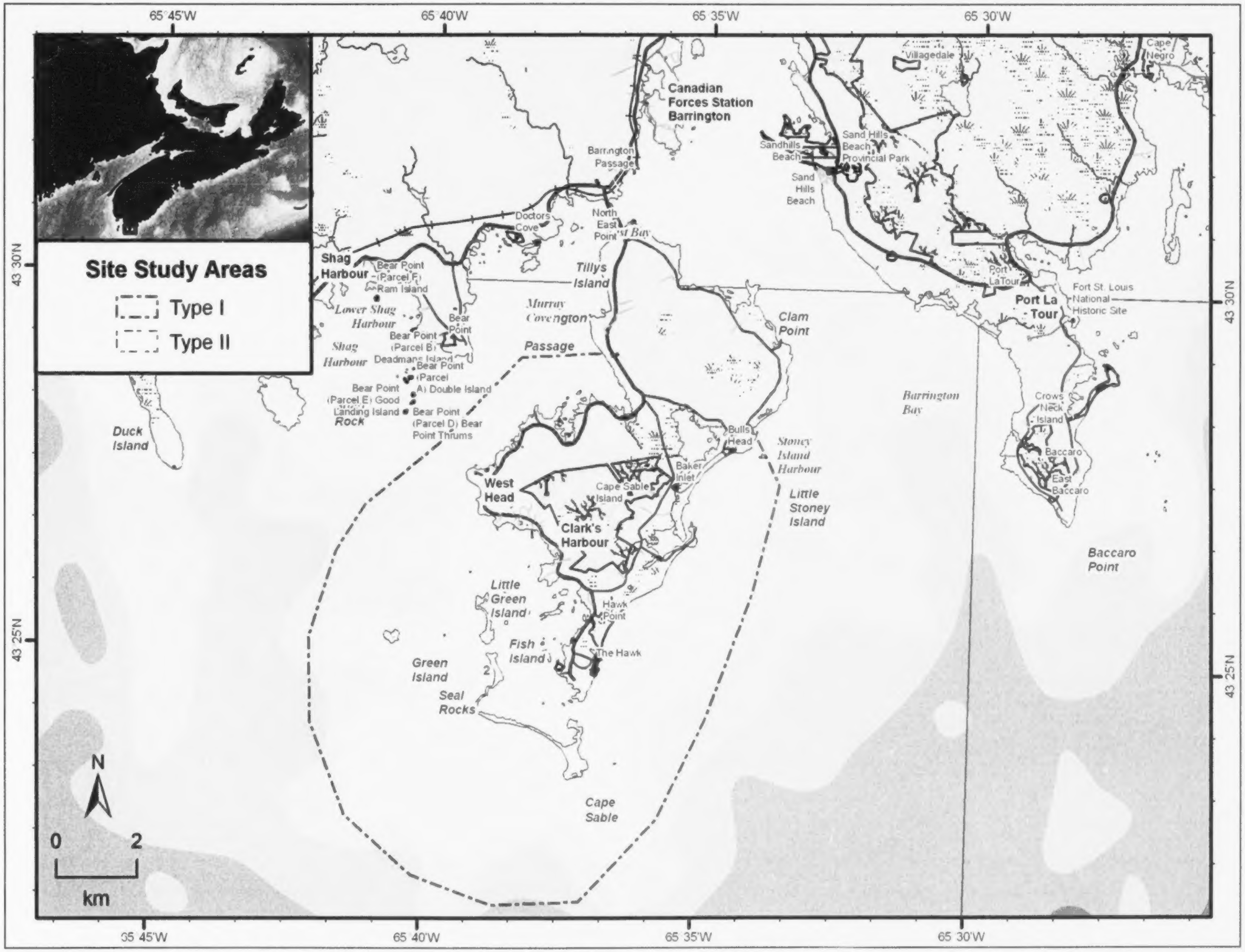
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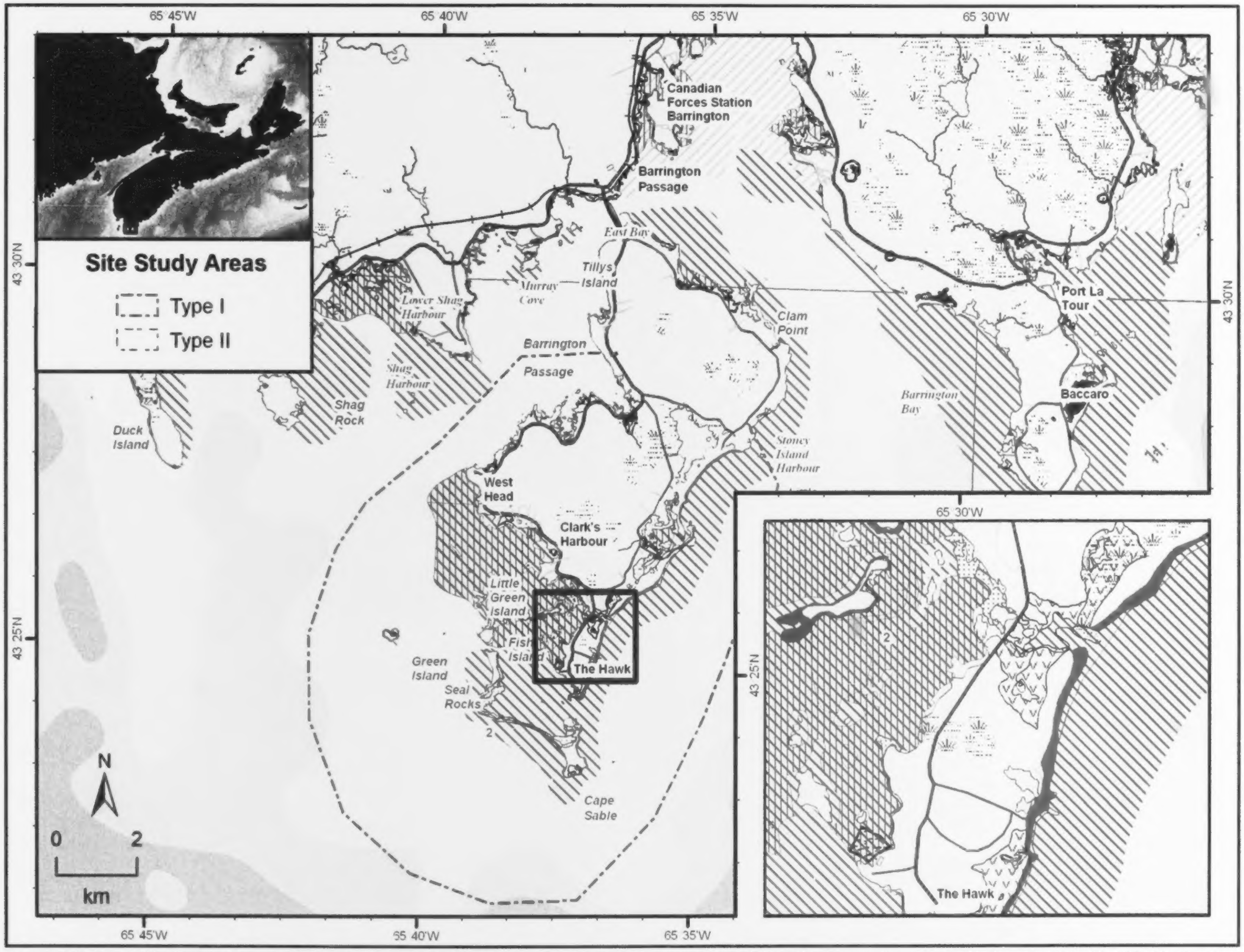
Figure 4.7 Location Map for Cape Sable Island (Site #2). Basemap layers: land 1: 50 000, 1: 250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); Restricted and Limited Use Land Database Layers (NSDNR 2006b). Refer to Figure 4.1 for legend.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Shag Harbour
Shag Rock
Duck Island
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Clam Point
Barrington Bay
Port La Tour
Baccaro
Stoney Island Harbour
West Head
Clark's Harbour
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Fish Island
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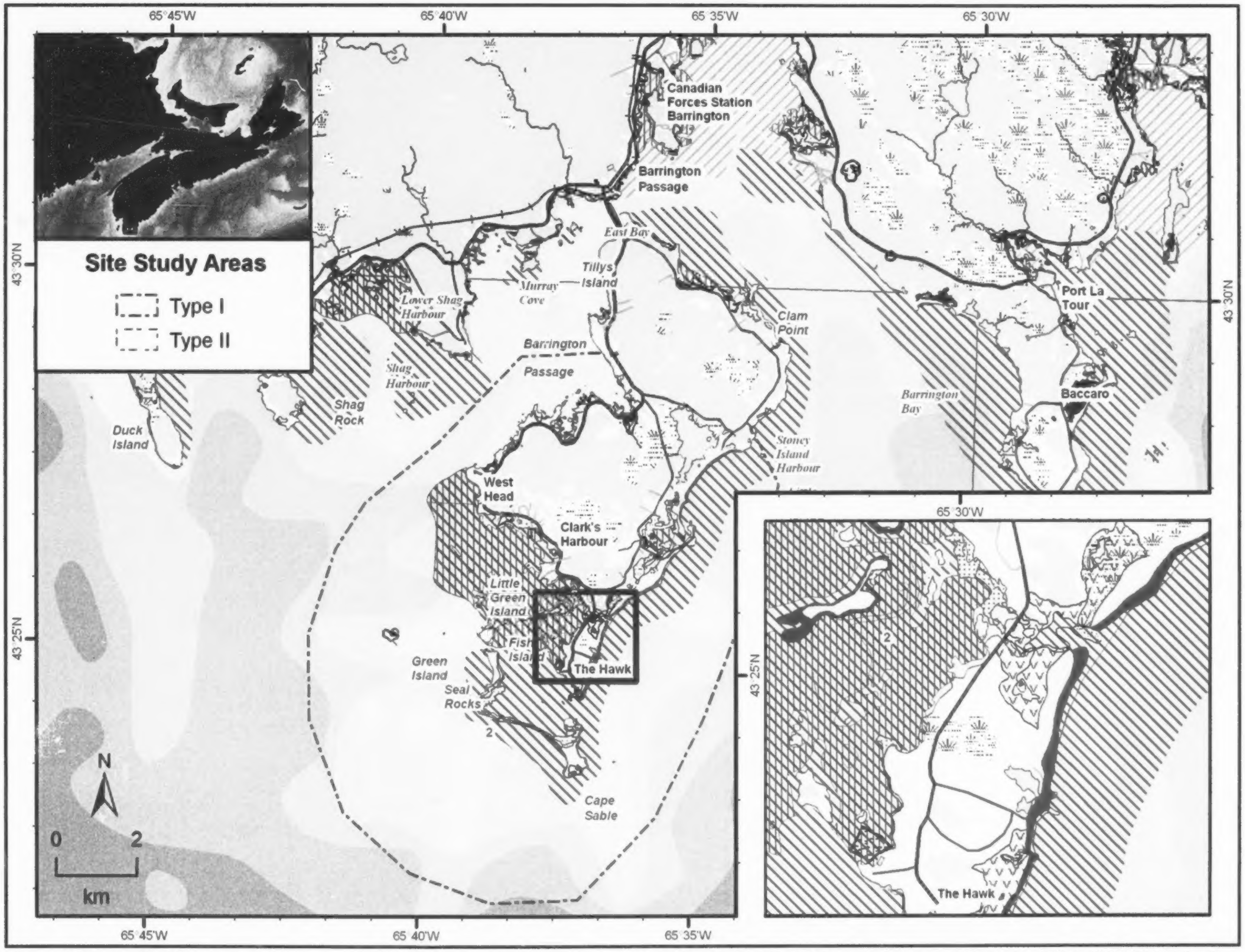
65 35'W
65 30'W
43 30'N
43 25'N
The Hawk

Figure 4.8 Coastal Habitats in Cape Sable Island (Site #2). Basemap layers: land 1:50 000, 1:250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); NSDNR Wetlands Database layers (NSDNR 2000). Refer to Figure 4.2 for legend.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Canadian Forces Station Barrington
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The Hawk

Figure 4.8 Coastal Habitats in Cape Sable Island (Site #2). Basemap layers: land 1:50 000, 1:250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); NSDNR Wetlands Database layers (NSDNR 2000). Refer to Figure 4.2 for legend.

Ecological Attributes

Cape Sable Island was identified by scientific experts as an EBSA. It meets all of the EBSA criteria and is considered highly resilient (Doherty and Horsman 2007). It was one of four areas identified more than five times by scientific experts in the EBSA identification process whereas many other areas were only identified once or twice (*Ibid.*).

The Cape Sable Island area has been described as having a high diversity of species (Clark 2006 *in* DFO 2006a; Mercier 1996) and as a productive marine ecosystem (Simon and Campana 1987). The area is particularly important for cod and lobster. It is a spawning ground and nursery area for Atlantic cod and lobster but is also a potential spawning area for other groundfish (Clark 2006 *In* DFO 2006a; Mercier 1996, Lane and Associates 1992). The area may also be a nursery area for herring, alewives, and sand lance, which were consistently found in samples taken in 2005 and 2006 (O'Connor 2008).

Cetaceans found offshore from the study area include the harbour porpoise, white-sided dolphin, grey and harbour seals, minke, fin, humpback, North Atlantic right, pilot, sei, and sperm whales (Mercier 1996). However, there are no current records of these species near the study area. Other species aggregations include the ocean quahog (Rowell and Chaisson 1983), cunner, lobster, sea raven, skates, spiny dogfish, winter flounder, Atlantic wolffish (Simon and Campana 1987), and scallops (Lane and Associates 1992). Southwest Nova Scotia is the most productive area for lobster in coastal Nova Scotia (Tremblay *et al.* 2009). Cape Sable Island is representative of this attribute, as it is one of the most important areas for the lobster fishery.

Marine species listed under SARA or assessed by COSEWIC that occur in or around the area include Atlantic cod (endangered, COSEWIC, Doherty and Horsman 2007), Atlantic wolffish (special concern, SARA, Harris 2006 *In* DFO 2006a; Simon and Campana 1987), spiny dogfish (special concern, COSEWIC, Simon and Campana 1987), harbour porpoise (special concern, COSEWIC, Lane and Associates 1992), and cusk which are generally caught offshore but some have been caught closer to shore near Cape Sable Island (threatened, COSEWIC, Harris 2006 *In* DFO 2006a). The fin whale may be found offshore of the study area (special concern, SARA) (Lane and Associates 1992). The Piping Plover (endangered, SARA; CWS), Roseate Tern (endangered, SARA; CWS), Harlequin Duck (special concern, SARA; Boyne 2008), Red Knot (*rufa* spp.; endangered, COSEWIC) use marine habitats found in the area.

There are extensive high and low salt marshes, especially at the south of the island, and extensive eelgrass beds (NSDNR 2000; Doherty and Horsman 2007). The Cape Sable and Lobster Bay areas have been described as having the most stable marine plant communities in the province and were unaffected by sea urchin outbreaks that occurred province-wide (G. Sharp, DFO Science Branch, pers. comm. 2009). Extensive kelp, rockweed, and Irish moss are present in the area (SCCRMP 1993; Doherty and Horsman 2007; G. Sharp, DFO Science Branch, pers. comm. 2009).

The localized persistent upwelling the area experiences creates a productive environment (Doherty and Horsman 2007; Lane and Associates 1992; Greenlaw 2009). The area is in a geographic position where extremely strong tidal currents, driven by the large tides within the Bay of Fundy "turn the corner", at about 1 m/s (Lane and Associates 1992). The waters off Cape Sable have anomalously low temperatures and high nutrients in the summer (Tee and Smith 1993). The area has been described as a "Significant area because it constitutes what is probably the most dynamic subtidal ecosystem in the world" (Scheibling, pers. comm. 2001 *In* McCullough *et al.* 2005).

The naturalness of the area is considered to be medium (Doherty and Horsman 2007), likely due to the variety of human uses that occur in the area including fishing, aquaculture, marine plant harvesting and dredging. Land-based development has some impacts on the degree of naturalness, however, the area has relatively low population with few industrial inputs. The area has also been described as resilient (*Ibid.*).

Bird Information

Cape Sable Island is well known for the diversity and abundance of birds it hosts and the site includes the smaller Eastern Cape Sable Island IBA (Number NS016). Intertidal beaches and mudflats in the area constitute important spring and fall migration stopover locations, notably for shorebird species, including Red Knot (*rufa* spp.; endangered, COSEWIC; CWS), globally significant numbers of Semipalmated Sandpiper and Short-billed Dowitcher, and nationally significant numbers of Willet (BLI 2009). Globally significant numbers of Atlantic Brant have been observed in this area (BLI 2009). Harlequin Duck (special concern, SARA; Boyne 2008) has also been recorded at this site during winter. During the summer breeding season, the area hosts nationally significant numbers of Piping Plover (endangered, SARA; CWS), and Canada's first breeding record for American oystercatcher. Colonies of Herring Gull, Great Black-backed Gull, Double-crested Cormorant, Common Tern, and Roseate Tern (endangered, SARA; CWS) are also found in the area. The area hosts very high numbers of geese, notably Atlantic Brant, and high to very high numbers of dabbling ducks with highest numbers found west of the Island. Very high numbers of bay ducks, including scaup and goldeneye, and sea ducks, including eiders and scoters, especially to the south east of the island, are also encountered in the area (CWS).

If the western boundary of the site were moved 8 km, it would include the Bon Portage Island IBA (Number NS015), a globally significant Leach's Storm-petrel colony (with over 100,000 individuals, it is the largest, by a factor of two, in the Maritime Provinces; CWS). Similarly, if the northern boundary were moved 10 km, it would include the South Shore (Barrington Bay Sector) IBA (Number NS018) in which thousands of shorebirds, including nationally significant Piping Plover numbers, have also been recorded.

Important Marine Ecological Features:

- High biodiversity and productivity - localized upwelling where tides "turn the corner"
- Spawning ground and nursery area for Atlantic cod and lobster
- Nursery area for herring, alewives, and sand lance
- SARA-listed species: Atlantic wolffish (special concern), Piping Plover (endangered,), Roseate Tern (endangered) and Harlequin Duck (special concern)
- COSEWIC-assessed species: Atlantic cod (endangered), cusk (threatened), harbour porpoise (special concern), spiny dogfish (special concern) and Red Knot (*rufa* spp.; endangered)
- Diverse and very extensive marine plants including kelp, Irish moss, and rockweed
- Extensive salt marshes and eelgrass
- Birds: IBA (1), species at risk, colonies, shorebirds, eelgrass habitat, geese, dabbling ducks, bay ducks, sea ducks

Human Uses

Human uses in the Cape Sable Island area include coastal development, fishing, marine plant harvesting, aquaculture, recreation, and tourism.

Coastal Development

Although Clark's Harbour has a high population density, the population of the area is declining and it is therefore unlikely that new residential development is occurring at a large scale. Municipalities surrounding the study area have comprehensive municipal planning strategies and land use bylaws (see Appendix D) (CBCL Limited 2009). Re-dredging was planned for West Head Harbour at the time of writing (CEAA 2009).

The area may have potential for wind energy development, with high wind speeds of 8.01-9.0 m/s on the island and surrounding mainland (Province of Nova Scotia 2010).

Commercial Fishing

Fisheries in the Cape Sable Island area are extremely important, as the livelihoods of many people in the area are tied either directly or indirectly to the fisheries. Cape Sable Island has more fishing infrastructure than most areas of Nova Scotia with numerous fish packers, processing plants, and public and private wharves. The largest fish processing plant on the island is Sable Fishpackers Ltd. (CCN 2006). Yarmouth, Pubnico, Cape Sable and LaHave have the highest landed value for all species in Nova Scotia, each making up 5% of total provincial landed values from 1991-2001 (CCN 2006).

LFA 34 has lobster grounds that are among the most productive in the world with landings in recent years exceeding 13,000 metric tonnes (MT) and account for 40% of Canada's landings and 23% of global landings (VDC 2009; DFO 2005a; Pezzack *et al.* 2006; Pezzack *et al.* 2001). LFA 34 comprises 61% of 2008 landings in DFO's Maritimes Region. In grid squares 157 and 158, the reporting units that most closely align with the study area, 2008 lobster landings are estimated at 1704 MT. These landings comprise 5.72% of 2008 landings in the Maritimes Region and 9.40% of LFA 34 landings in 2008. Landings in this area and in Lobster Bay are significantly higher than other sites in this analysis (VDC 2009).

The majority of groundfish landings are low, especially further inshore (VDC 2009), but Atlantic halibut landings were high from 1999-2003 (DFO 2005a). There is no mobile gear used for groundfish; they are caught using longlines and handlines. Until recently, there was an active haddock handline fishery (Clark 2006 *in* DFO 2006a).

The area east of the study area (south of Baccaro) has high scallop landings (VDC 2009) and the nearby offshore areas are very important scallop grounds (DFO 2005a), however, little scallop dragging occurred within the study area in recent years (2007-2009); most is immediately adjacent to the eastern boundary of the study area (VDC 2009). East of the study area beginning near Baccaro Point, there are a few concentrated areas of scallop fishing (M. Butler, Fisheries and Aquaculture Management Branch, pers. comm. 2010). There were low scallop landings in the area from 1999-2003 (DFO 2005a). Table 4.3 summarizes commercial fisheries in Cape Sable Island.

There is also recreational and commercial clam digging which occurs in the intertidal areas (NSDNR 2009a, M. Butler, Fisheries and Aquaculture Management Branch, pers. comm. 2010) and a small amount of dredging for Stimpson's surf clam east of Cape Sable Island (VDC 2009).

Shelburne County had 7 active and 1 inactive urchin licenses in 2000 (DFO 2000). Urchin fishing in the Cape Sable area at present is unknown.

Table 4.3 Summary of Major Commercial Fisheries and Gear Used in and Adjacent to the Cape Sable Island Area

Species	Landings*	Gear	Year	Source
Groundfish (primarily halibut)	M	Bottom longline/handline	1999-2003 2007-2009	DFO 2005a VDC 2009
Stimpson's surf clam	L	Hydraulic Dredge	2007-2009	VDC 2009
Scallop	L	Dredge	1999-2003 2007-2009	DFO 2005a VDC 2009
Lobster	H	Trap	2008	VDC 2009

*H = high, M = medium, L = low

Marine Plant Harvesting

Rockweed harvesting is most intense along the south shore of Nova Scotia where it is managed by leases granted for annual harvests of over 4 tonnes with associated harvest controls, such as closed areas and regulations against harvesting more than 15% of the holdfast by weight (Rock Weed Harvesting Regulations made under Section 71 of the *Fisheries and Coastal Resources Act 1996*). However, most harvesting in Nova Scotia occurs in Lobster Bay (NSDFA 2007b). Acadian Seaplants Ltd. has several leases around Cape Sable Island (Ugarte *et al.* 2009). The level of harvesting intensity for Cape Sable Island is undetermined. Irish moss is also harvested in the area. Irish moss has changed composition resulting in fewer pure stands making harvesting difficult (Sharp *et al.* 2008). Marine plant harvesting in this region has occurred since the 1940's (Sharp *et al.* 2008).

Aquaculture

There are two aquaculture licenses in the area, one is land-based in Clark's Harbour for Atlantic cod and Atlantic halibut and the other is in Barrington Passage for Atlantic cod (see Figure 4.9, Service Nova Scotia 2008). The Barrington Passage site was sampled under the EMP in 2005 (NSDFA 2006). Aquaculture makes up 0.03 % of the study area.

There is also an active site at Woods Harbour for Atlantic salmon and a shellfish operation in Shag Harbour with the license holder under review (Service Nova Scotia 2008; NSDFA 2006).

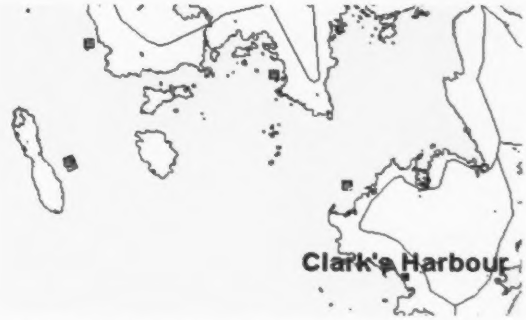


Figure 4.9 Aquaculture Licenses/Leases at Cape Sable Island (denoted by green squares) (Service Nova Scotia 2008)

Tourism, Recreation, and Culture

Boatbuilding contributes to the economy and has a century long history (STS Dezign 2008). Tourism activities are generally low with few amenities on the island for tourists, including a few small guesthouses, one restaurant, and C & J's Ocean View Tours (STS Dezign 2008). The area is very popular for bird watching.

Current Protection and Research/Conservation Initiatives

The ecological importance of the area is highly recognized by several government departments. Cape Sable Island was one of the four areas with the highest level of interest for conservation within CPANS. The area is a proposed WMA under Nova Scotia's Department of Natural Resources mandate (NSDNR 2009a).

The ecological importance of this area is also recognized by Parks Canada. Lane and Associates (1992) recommended the Cape Sable and Roseway Basin area as one of three candidate areas for further assessment by Parks Canada. The area was later confirmed as one of three representative marine areas (RMAs) of the Scotian Shelf marine region and was found to be considerably more representative than the other two areas, the Canso Offshore Islands and the Sable Island/Gully RMAs (Mercier 1996). The identification of RMAs is the first step in the NMCA process (*Ibid.*). In 1996, Mercier (1996) recommended that the Cape Sable and Roseway Basin area be pursued as an NMCA candidate for the Scotian Shelf marine region, however, Parks Canada is not currently pursuing an NMCA designation in this region.

There is some terrestrial protection on Cape Sable Island including a designated IBA (although unlegislated), EHJV Lands, the Hawk Protected Beach, and two small Non-designated Parks and Park Reserves, one which is directly adjacent to the coast (NSDNR 2006b).

Research of the marine environment is limited to a few trawl surveys and dive transects conducted in the 1980s (Simon and Campana 1987; Moore and Miller 1983). More is known about the birds, through Atlantic Canada Shorebird Survey which has been ongoing since the 1970s (BSC 2009). Long-term monitoring of the marine ecosystem is necessary to fully understand the significance of the marine area, however, the productivity of the area is well recognized.

Summary

Table 4.4 below summarizes the key information provided in the site profile. Cape Sable Island has several important ecological attributes that are recognized by other federal and provincial government departments that align with all of the *Oceans Act* criteria for MPA establishment.

Table 4.4 Summary of Cape Sable Island Site Profile

Oceans Act Criteria (s.35)	Ecological Attributes	Human Uses	Current Protection and Research Initiatives
(a) The conservation and protection of commercial and non-commercial fishery resources, including marine mammals, and their habitats; (b) The conservation and protection of endangered or threatened marine species, and their habitats (c) The conservation and protection of unique habitats; (d) The conservation and protection of marine areas of high biodiversity or biological productivity	• High biodiversity and productivity - localized upwelling where tides "turn the corner" • Spawning ground and nursery areas for cod and lobster • Nursery area for herring, alewives, and sand lance • SARA species: Atlantic wolfish, Piping Plover, Roseate Tern and Harlequin Duck • COSEWIC species: Atlantic cod, cusk, harbour porpoise, spiny dogfish, and Red Knot (*rufa* spp.) • Diverse and extensive marine plants including kelp, Irish moss, and rockweed • Extensive salt marshes and eelgrass beds • Birds: IBA, colonies, shorebirds, eelgrass habitat, geese, dabbling ducks, bay ducks, sea ducks	• Fishing - lobster - scallops - Stimpson's surf clam - groundfish (especially Atlantic halibut) - soft-shell clam • Rockweed and Irish moss harvesting • Aquaculture: finfish and shellfish • Minimal tourism and recreation • Proposed re-dredging project • Moderate coastal development	• Recognized conservation importance among other federal and provincial departments • Some terrestrial protection • Recent marine data are lacking

4.3 Port Joli and the Kejimkujik Seaside Adjunct

The Port Joli and Kejimkujik National Park, Seaside Adjunct area has minimal development, representing one of few relatively pristine coastal areas remaining on the south shore of Nova Scotia. It has a high proportion of coastal protection and provides important habitat for migratory birds. Extensive eelgrass beds, salt marshes, and white-sand beaches provide a diversity of habitats that support equally diverse marine species such as herring, invertebrates, and several juvenile fish. There is a herring spawning area that may be important at the provincial scale. Human uses include residential development, marine plant harvesting, and a herring roe fishery. The area has several research initiatives and there is substantial interest for marine protection from protected area practitioners and non-government organizations.

Location and Population

Port Joli is located in southwest Nova Scotia, Queens County. The study area comprises the entire Port Joli inlet and extends seaward approximately 3.5 km from Port Joli Head including the entire coastal portion of the Kejimkujik Seaside Adjunct. The total study area is approximately 80.7 km^2. See the Port Joli location map (Figure 4.11).

The coastal town of Liverpool is the largest town nearby and is found approximately 27 km northeast. The area has a population of approximately 1,187 which includes several surrounding coastal and inland areas, with Port Mouton having the greatest population (Province of Nova Scotia 2009b). The year-round population of Port Joli is only about 20-25 people but increases to approximately 100 in the summer months with the arrival of summer home owners (B. Bowers, pers. comm. 2009). The area has a low population density of 0-10 people per km^2 (Municipal Services 2001).

Physical and Oceanographic Attributes

The Port Joli inlet has a total area inshore from Wreck Point and Port Joli Head of approximately 20.2 km^2 including intertidal areas (this is only a portion of the study area). The inlet has a total coastline length of 26.5 km (DFO 2007d). Port Joli has a relatively extensive intertidal area at the head of the inlet and a maximum depth of 20.1 m within the inlet. The inlet is not predominantly intertidal as might be expected, but is quite shallow with a depth of 1.83 m throughout most of the inlet (DFO 2007d). The maximum depth of the study area, offshore from the Kejimkujik Seaside Adjunct, is 40 m (Canadian Hydrographic Service (CHS) Chart 4240). See Figure 4.10 for a bathymetry map of Port Joli. The inlet has freshwater input with a watershed drainage area of 78.3 km^2, has a tidal to freshwater ratio of 499.4:1, and a flushing time of 47.3 hours (DFO 2007d). Port Joli is classified as a Complex Mixed Bay (Greenlaw 2009).

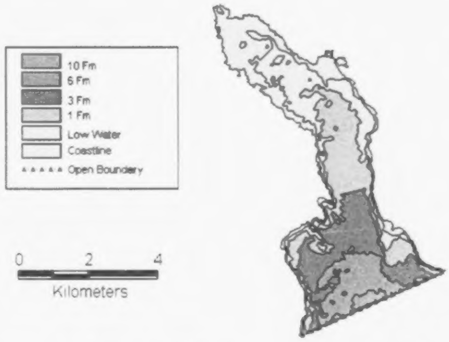


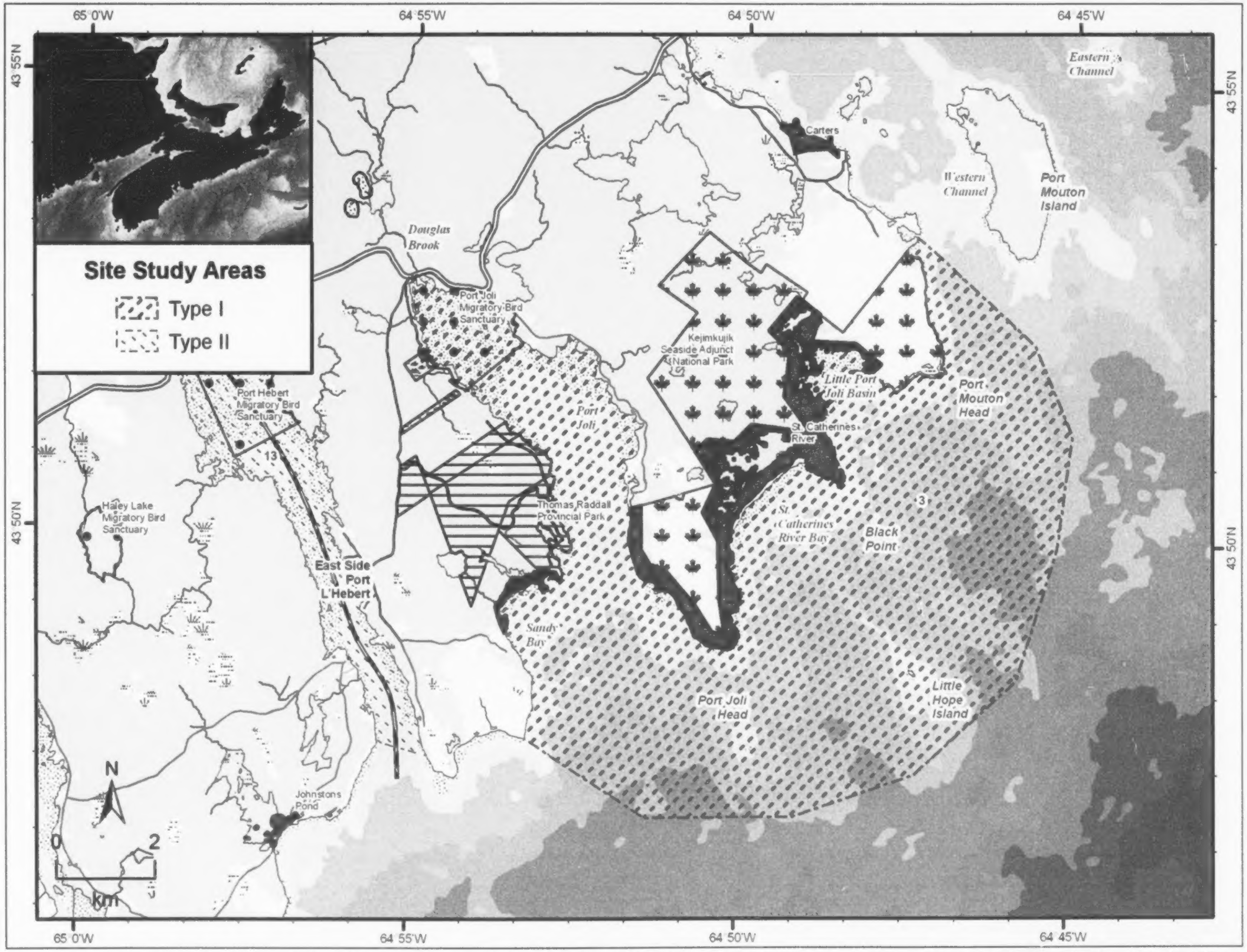
Figure 4.10 Port Joli Bathymetry (DFO 2007d)
1 Fm = 1.83 m , Coastline = intertidal zone

The Port Joli inlet and Kejimkujik Seaside Adjunct area shares the same geomorphic characteristic of the Cape Sable Island area which is common in the south shore. The dominant bedrock is greywacke with granite intrusions and the terrain has very little relief but an indented coastline with long narrow inlets that are drowned river estuaries (Davis and Browne 1996b). There are very few glacial deposits.

The coast is a high energy wave environment and consists of dunes, flat sand beaches, and tidal marshes. These coastal features are shown in Figure 4.12. The area experiences higher temperatures than the rest of the Atlantic coast (*Ibid.*).

The study area contains a diversity of habitats including abundant and extensive estuarine and marine flats containing salt marshes, eelgrass beds, barrier beaches, and dunes in the Kejimkujik Seaside Adjunct. The lagoons of the Kejimkujik Seaside Adjunct have a benthic habitat ranging from bedrock and boulders in the channels to fine sand and mud in the innermost areas. The barrier beaches of Kejimkujik Seaside Adjunct are composed of relict sediment (Brylinsky *et al.* 1987), as are most of the beaches in the area, and very little is derived from coastal erosion (Davis and Browne 1996b) resulting in high vulnerability of the area to sea level rise (NRCan 2007). The Port Joli inlet has extensive intertidal and subtidal mudflats which are important for the growth of eelgrass that supports overwintering Canadian Geese (Environment Canada 2004).

Port Joli contains drowned forests, archaeological sites, and exposed terrestrial paleosols in intertidal swash zones, which demonstrates that the area is experiencing ongoing transgression (Miller 2000).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Site Study Areas
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Carters
Western Channel
Port Mouton Island
Douglas Brook
Port Joli Migratory Bird Sanctuary
Kejimkujik Seaside Adjunct National Park
Little Port Joli Basin
Port Mouton Head
Port Hebert Migratory Bird Sanctuary
Port Joli
St. Catherines River
13
Haley Lake Migratory Bird Sanctuary
Thomas Raddall Provincial Park
St. Catherines River Bay
Black Point
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East Side Port L'Hebert
Sandy Bay
Port Joli Head
Little Hope Island
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Johnstons Pond

Figure 4.11 Location Map for Port Joli (Site #3). Basemap layers: land 1: 50 000, 1: 250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); Restricted and Limited Use Land Database Layers (NSDNR 2006b). Refer to Figure 4.1 for legend.

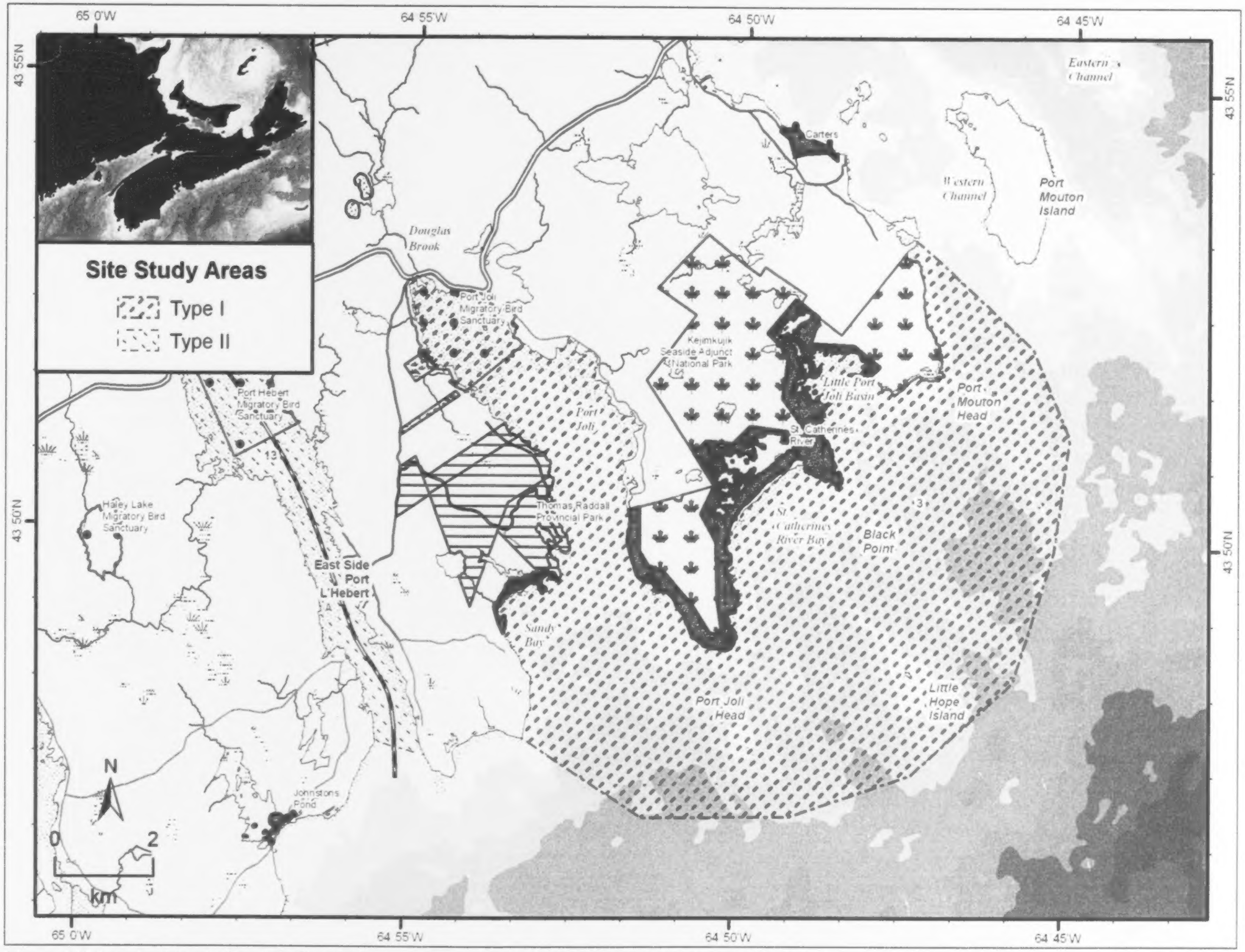
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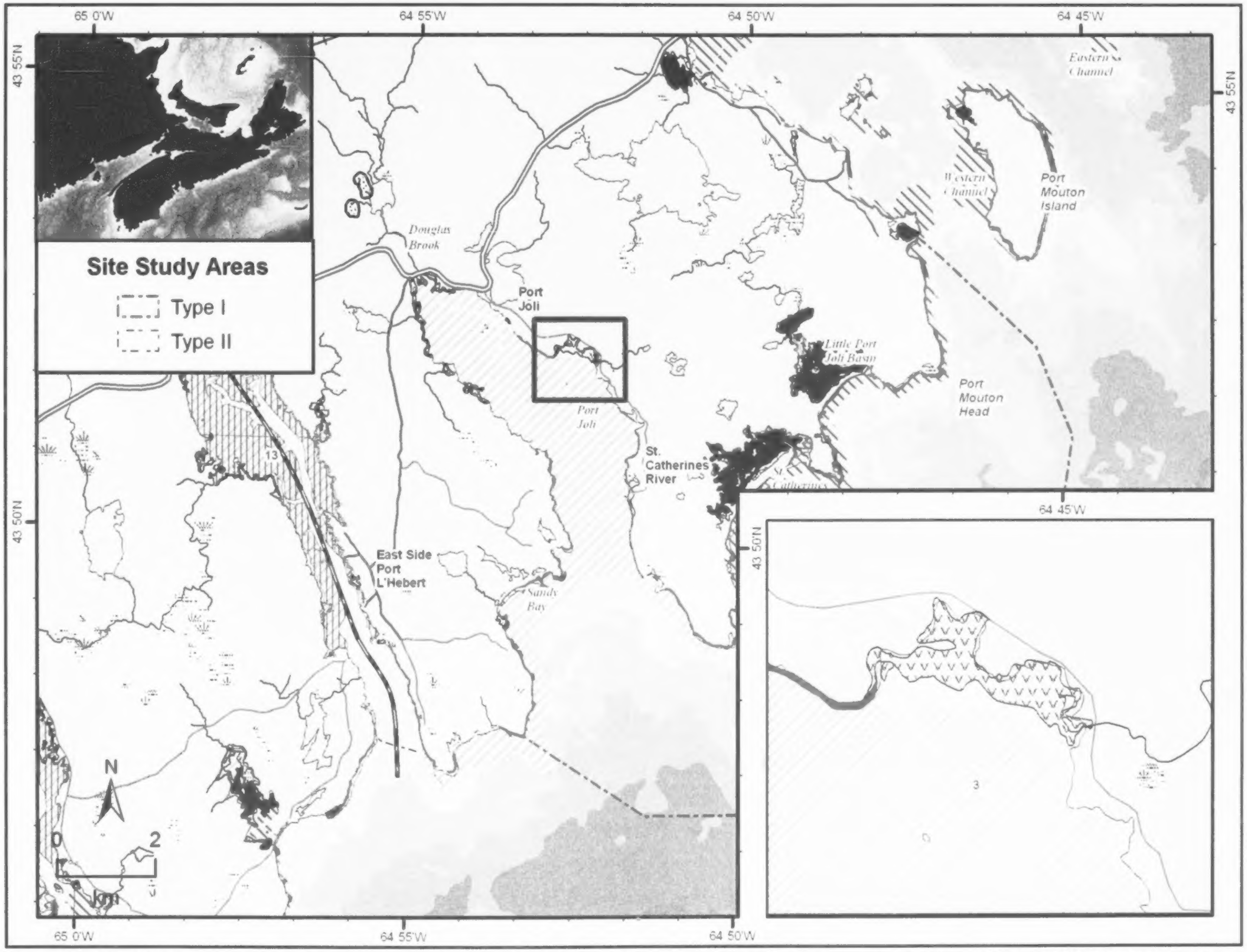
Figure 4.11 Location Map for Port Joli (Site #3). Basemap layers: land 1: 50 000, 1: 250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); Restricted and Limited Use Land Database Layers (NSDNR 2006b). Refer to Figure 4.1 for legend.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Little Port Joli Basin
Port Mouton Head
St. Catherines River
East Side Port L'Hebert
Sandy Bay
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Figure 4.12 Coastal Habitats in Port Joli (Site #3). Basemap layers: land 1:50 000, 1:250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); NSDNR Wetlands Database layers (NSDNR 2000). Refer to Figure 4.2 for legend.

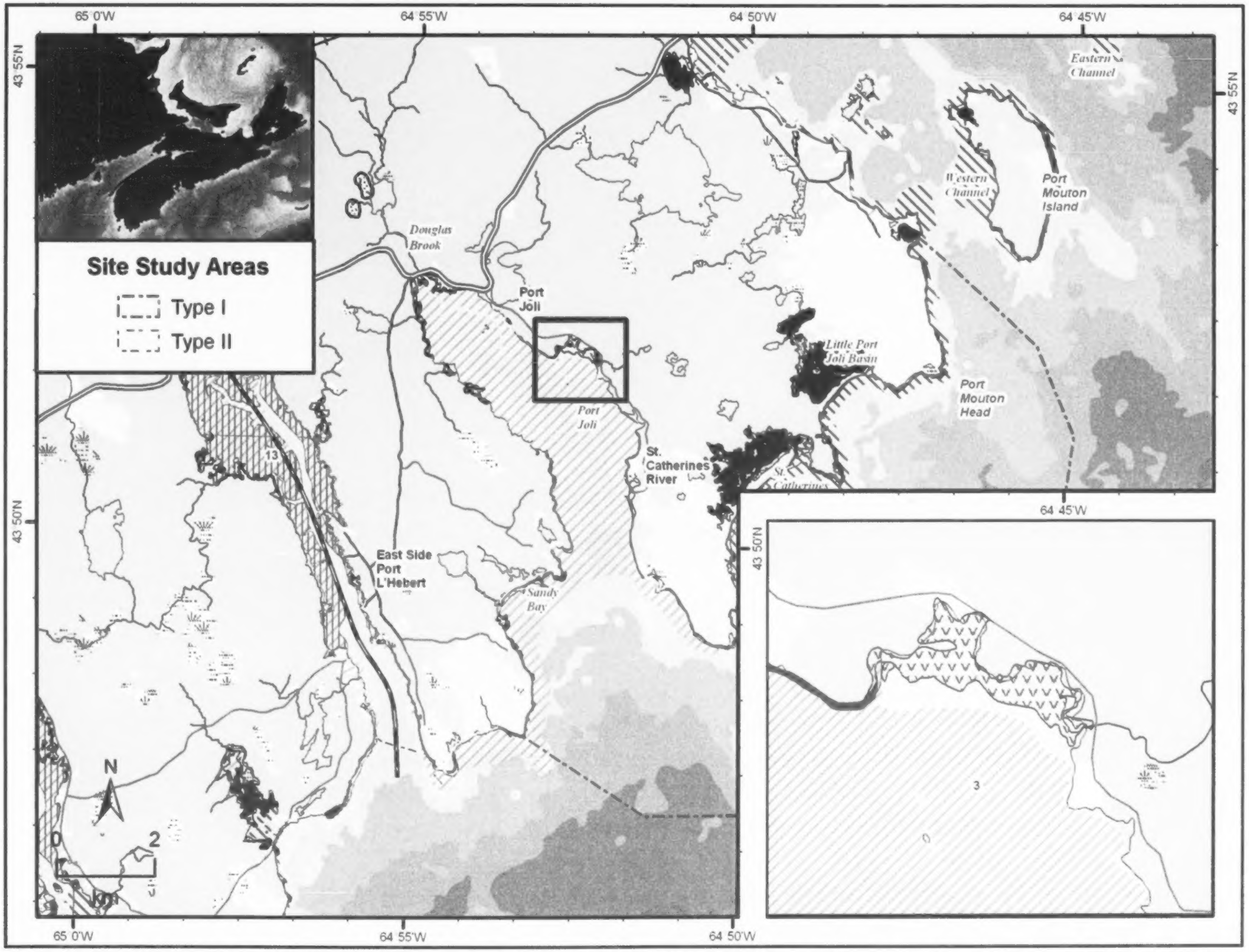
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Figure 4.12 Coastal Habitats in Port Joli (Site #3). Basemap layers: land 1:50 000, 1:250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); NSDNR Wetlands Database layers (NSDNR 2000). Refer to Figure 4.2 for legend.

Ecological Attributes

The Port Joli area was identified by scientific experts as an EBSA. It meets all of the EBSA criteria with high aggregations and high resilience (Doherty and Horsman 2007). Port Joli was identified three times by scientific experts and the Kejimkujik Seaside Adjunct and offshore area was identified 1-2 times in the EBSA identification process (*Ibid.*). Port Joli was originally classified as a Type II site and was later classified as a Type I site due to the high potential for collaboration with other federal and provincial departments based on results of the first CPANS meeting in December, 2008.

Port Joli and Kejimkujik have extensive eelgrass beds and salt marshes which may provide refuge and foraging areas for marine species and primary productivity for the surrounding waters. There is also diverse and abundant algae toward the mouth of the inlet (Brothers 1997).The extensive eelgrass is a potential nursery area for juvenile fish species which are known to associate with this habitat type (Heck *et al.* 2003). Nekton samples taken in the Kejimkujik lagoons in the 1980s included several juvenile species such as American sand lance, American eel, four/three/nine-spine and blackspotted stickelback, herring, mummichog, little sculpin, pollock, winter flounder, Northern pipefish, and hake (Brylinsky *et al.* 1987). Atlantic cod (endangered, COSEWIC) are present in the area and have been caught as bycatch in lobster traps (B. Bowers, pers. comm. 2009).

Little Hope Island, seaward of the Kejimkujik Seaside Adjunct, is a herring spawning area. Little Hope Island is one of only four current herring spawning areas within the scope of this report and one of seven areas along the coast of Nova Scotia and in the Bay of Fundy (DFO 2008a). Lobster Bay, the Bras d'Or Lakes, and a large area off Cole Harbour and the Chezzetcook to Jeddore study areas are also current herring spawning areas (*Ibid.*). At Little Hope Island there are genetically and morphometrically distinct sympatric subpopulations or spawning waves from three other spawning populations near Nova Scotia, which is uncommon to other spawning areas in Nova Scotia according to an acoustic survey by McPherson *et al.* (2003).

There is an abundance of invertebrates in the intertidal and subtidal mudflats including soft-shell clam, bar clam, blood worm, horse mussels (QCCRMP 1996), sea urchins and lobster (Brothers 1997). Other marine aggregations include pollock, Atlantic cod (QCCRMP 1996), harbour and grey seals (A. Pelletier, pers. comm. 2009), and one cetacean species was noted in the offshore area by King (2004).

Dive transects were conducted by the Canadian Parks and Wilderness Society, Nova Scotia Chapter (CPAWS-NS) in July and August 2009 in Port Joli and the Eastern Shore Islands WMA. Data were recorded along twenty-two transects of 50 m in length. Preliminary results demonstrate that the areas studied had 5.3% mean kelp cover and 14.8% mean eel grass. Very few fish were observed on the transects. Common invertebrates included periwinkles, blue mussels, rock crab, green crab, hermit crab, sand shrimp, whelks, lobster with a few copepods, barnacles, sponges, tunicates and limpets. There were an average of 10.8 lobsters per transect on sandy bottoms deeper than 4 m. A full assessment of the findings will be made available in 2010 (CPAWS-NS, unpublished data, 2009).

The Port Joli area may have the highest degree of naturalness of any other area in this analysis, likely as a result of conservation efforts in the area, the low level of development, and numerous terrestrial protection measures. Miller (2000) states, "A Port Joli Harbour Marine Protected Area would also help facilitate scientific research into the changing natural coastal environment by providing an undisturbed marine benchmark upon which to measure change".

Bird Information

This and the Port l'Hebert sites are included within the boundaries, and coincide with much of the northern third of the much larger South Shore (Port Joli sector) IBA (Number NS004). This IBA is important as a spring and fall migration stopover location for continentally significant numbers of Canada Goose (BLI 2009), comprising 30-40% of Atlantic Canada's overwintering population (NCC 2006). Continentally important numbers of Piping Plover (endangered, SARA; CWS) use beaches here during summer for breeding. The general area of the IBA is known to host nationally significant numbers of migrating shorebird species, including Semipalmated Sandpiper, Willet, Least Sandpiper and Pectoral Sandpiper (BLI 2009). Colonies of Double-crested Cormorant, Great Black-backed Gull, Great Blue Heron, Common Eider, and both Common and Arctic Tern species are found here (CWS). Very high eelgrass densities may contribute to very high numbers of migrating and wintering geese and dabbling ducks. Very high numbers of bay ducks and sea ducks can also be found here (CWS).

Important Marine Ecological Features:

- Herring spawning area at Little Hope Island
- Nursery area for a multitude of fish species including herring, pollock, and winter flounder
- Extensive eelgrass beds and salt marshes
- SARA-listed species: Piping Plover (endangered)
- COSEWIC-assessed species: Atlantic cod (endangered)
- Intact marine environment with several adjacent terrestrial protected areas
- Abundance of invertebrates; urchin and lobster habitat
- Seal haul-outs
- Birds: IBA (1), eelgrass habitat, shorebirds, important area for migratory birds, geese, dabbling ducks, bay ducks, sea ducks

Human Uses

Port Joli and the Kejimkujik Seaside Adjunct area experience limited coastal development, fishing, marine plant harvesting and tourism, although most of these uses are of low intensity. Port Joli is one of the few coastal inlets in this analysis where no aquaculture leases exist (Service Nova Scotia 2008).

Coastal Development

Although the area is relatively natural, there is recognition that increasing the level of residential development could impact sensitive eelgrass and salt marshes which are highly productive environments that support numerous birds and marine species in Port Joli. The Nature Conservancy of Canada recognizes the ecological importance of the area and has placed priority on protecting these lands from development through the purchase of 55 ha of land (NCC 2006) and recently purchased an additional 138 ha (Roberts 2009). Although the area currently has a low population density, coastal properties are prime real estate and are being bought for summer homes, particularly by retirees (NCC 2006). Eelgrass has already declined in the Kejimkujik lagoons due to unknown causes (A. Pelletier, pers. comm. 2009) and further development could pose an impact on the coastal habitats within Port

Joli. The study area does not have a comprehensive municipal planning strategy or land use bylaws, which is also the case for the surrounding areas (see Appendix D) (CBCL Limited 2009).

Commercial Fishing

There is minimal fishing in the area relative to the rest of Nova Scotia. The two fisheries are lobster and herring roe, the latter being of greater significance. The herring roe fishery takes place at the mouth of the Port Joli inlet or offshore from the Kejimkujik Seaside Adjunct (DFO 2005a), but the fishing locations vary from year to year in the vicinity of the site (VDC 2009).

The Herring Roe Fishery of Little Hope Island

Following a concentrated purse seine effort in 1993-1994, concern for this herring spawning stock was expressed by the Scotia-Fundy Herring Advisory Committee (SFHAC) which resulted in a closure of all coastal embayments between Cape Sable Island and Sheet Harbour to mobile gear for herring. A herring roe fishery using mid-water gillnets at Little Hope Island continued and there were 2 exploratory licenses for herring purse seine operations (DFO 2001b).

According to the Friends of Port Mouton Bay (2007), in 2006 there were 44 boats that participated in the Little Hope Island herring roe fishery. Most of the herring roe boats come from the Pubnicos, Yarmouth, Meteghan, and Little River while only a few fish out of Port Mouton. "The first day fished was September 27, last day fished October 27. There was a total of 20 fishing nights and an average of 339,595 lbs. caught per night. There were 5 fish plants buying the herring" (Friends of Port Mouton Bay 2007).

In 2007 the Little Hope acoustic spawning biomass declined 90% from 2006 levels (DFO 2008a). In 2007 there were 1,500 tonnes (3,307 lbs) of herring landed at Little Hope Island which is less than half of 2006 landings (*Ibid.*). "The decline in or lack of surveyed biomass of all three major coastal spawning groups is cause for concern" (*Ibid.*). It was recommended that "no coastal spawning areas experience a large effort increase until enough information is available to evaluate the state of that spawning group" (*Ibid.*). In 2008 there was an increase in surveyed acoustic biomass in the Little Hope/Port Mouton area, but biomass is still below average (*Ibid.*).

Landings from 2007-2009 were medium to high on a provincial scale (VDC 2009).

The lobster fishery in this area is of low importance at the provincial scale. In grid square 308, the reporting unit that most closely aligns with the study area, 2008 lobster landings are estimated at 133 MT. These landings comprise 0.45% of 2008 landings in DFO's Maritimes Region and 4.30% of LFA 33 landings in 2008. LFA 33 comprises 10% of 2008 landings in the Maritimes Region (VDC 2009).

There are only 12 boats fishing for lobster in the immediate area and they are coming from the wharf in Port l'Hebert (B. Bowers, pers. comm. 2009). Most lobster fishing occurs on the northeast side of the inlet and a lot more off the headlands of Kejimkujik Seaside Adjunct (*Ibid.*).

Other commercial fisheries occurring in the inlet at small scales include quahog, blood worm, periwinkles, and green and rock crab (B. Bowers, pers. comm. 2009). Urchin fishing occurred approximately 10 years ago but has not occurred since (A. Silva, DFO Science Branch, pers. comm. 2009). Low landings of groundfish were once caught near the headlands of the Kejimkujik Seaside Adjunct (DFO 2005a) but groundfish has not been landed in the area in years. There was once a commercial gaspereau fishery where Robertson's Lake drains into the inlet and there was also an eel trapping fishery. Both do not occur at present (B. Bowers, pers. comm. 2009).

Soft-shell clam harvesting occurs in minimal quantities in Port Joli and there may be some poaching in the Kejimkujik Seaside Adjunct (A. Pelletier, pers. comm. 2009). Recreational harvesting of soft-shell clams at Thomas Raddall Provincial Park is permitted (B. Bowers, pers. comm. 2009). There has been interest in hydraulic dredging for clams in Port Joli in the past but community opposition prevented the activity. There is also an increase in periwinkle harvesting in Port Joli and there has been periwinkle poaching in the Kejimkujik lagoons (B. Bowers, pers. comm. 2009). Table 4.5 below summarizes major commercial fisheries in Port Joli.

Table 4.5 Summary of Major Commercial Fisheries and Gear Used in and Adjacent to Port Joli

Species	Landings*	Gear	Year	Source
Herring roe	M-H	Drift gillnet	2007-2009	VDC 2009
Lobster	L	Trap	2008	VDC 2009

*H = high, M = medium, L = low

Marine Plant Harvesting

A small portion of the mouth of Port Joli Harbour is leased for rockweed harvesting (Justin Huston, Nova Scotia Fisheries and Aquaculture, per. comm. 2009), however, landings are minor compared to Lobster Bay and Cape Sable Island.

Irish moss is also harvested (B. Bowers, pers. comm. 2009). Due to increasing demand, a decline in Irish moss landings and changes in stand composition in Lobster Bay, areas further east are being explored for harvesting potential (Sharp *et al.* 2008). There is no known interest for industry expansion in Port Joli.

Tourism, Recreation, and Culture

Although there are no hotels or restaurants in the immediate area, there are several outdoor recreational opportunities such as kayaking, surfing, camping at Thomas Raddall Provincial Park, hiking in Kejimkujik National Park and enjoying the many beaches in the area. The Rossignol Surf Shop rents kayaks and surfboards and gives lessons in the summer. Hunting is a past-time, especially of local fish harvesters, which prompted the designation of the Port Joli MBS for the protection of waterfowl and shorebirds. Visitations to the Kejimkujik Seaside Adjunct area and Thomas Raddall are increasing and there are several people coming from away and from other parts of Nova Scotia to buy land in the Port Joli-Port l'Hebert area (B. Bowers, pers. comm. 2009).

Shell middens are of archaeological importance and provide evidence of Mi'kmaq occupation dating back as long as 1200 years ago (Environment Canada 2004). These middens are under threat of erosion and destruction from recreational activities and there is interest in their protection (R. Ogilvie, Nova Scotia Department of Tourism, Culture, and Heritage, pers. comm. 2009).

Current Protection and Research/Conservation Initiatives

There are numerous coastal protected areas in and around Port Joli including:

- Port Joli MBS (significant marine component)
- Thomas Raddall Provincial Park
- Kejimkujik National Park – Seaside Adjunct (includes the lagoons)
- 55 ha of NCC Lands just inland from the MBS and 138 ha was recently purchased

(NSDNR 2006b; Service Nova Scotia 2006)

There is a high level of support from provincial and federal departments (CPANS) for marine protection in the Port Joli area. Lane and Associates (1992) identified this area, as well as 16 others, as a potential site of significance during an initial scoping exercise, but later dropped the area prior to making its recommendations to Parks Canada. Parks Canada is not currently pursuing an NMCA designation in the Scotian Shelf marine region. Lane and Associates (1992) regarded it as one of few areas in coastal Nova Scotia that remains relatively undeveloped.

The area is an IBA (BSC 2009) and was proposed as an adjunct to the Kejimkujik-Tobeatic Biosphere Reserve proposal for central southwest Nova Scotia (Miller 2000). It was proposed as the coastal nucleus for the large Scotian Coastal Plain Biosphere Reserve proposal which included a significant marine component (*Ibid.*).

Research

Although public information of the study area is outdated, there are research efforts underway and data are being collected by federal and provincial government departments and NGOs.

Port Joli is one of two Natural Geography Inshore Areas Project (NaGISA) sites in Nova Scotia; the other is in Canso. The NaGISA project is a Census of Marine Life project and has 128 sampling sites in 51 countries. NaGISA's primary goal is to establish well distributed transects from the intertidal zone to 20 m for repetition over a 50 year or longer time frame for long-term monitoring (NaGISA 2009). This work is being conducted by DFO Science. The NaGISA site in Port Joli is specific to the monitoring of eelgrass and monitoring began in 2008. There is consideration for the establishment of a second NaGISA site for the long-term monitoring rocky shores in Port Joli Basin (A. Silva, DFO Science Branch, pers. comm. 2009).

DFO and NSNDR are collaborating on an initiative to identify appropriate methods to map and monitor eelgrass, using Port Joli and the Musquodoboit estuary as study areas. Eelgrass has recently been recognized as an Ecologically Significant Species (DFO 2009e) and is experiencing rapid declines globally which has several implications for ecosystem health (Waycott *et al.* 2009).

The Port Joli Basin Conservation Society is a local group of naturalists that meets to discuss conservation in the basin and has sponsored research initiatives in the basin (Port Joli Basin Conservation Society 2009). The society is made up primarily of local residents and summer home owners.

In addition to the work of the NCC mentioned above and other research initiatives in support of conservation, the CPAWS-NS is currently working in the area to discuss conservation issues, concerns, and interests within the community of Port Joli. They also conducted dive transects within Port Joli in July and August 2009 to fill information gaps of current species and habitat distribution, as mentioned in the Ecological Attributes.

Summary

Table 4.6 below summarizes the key information provided in the site profile. Port Joli has important coastal habitats that support several migratory birds and aquatic species. The area is recognized as a high priority for conservation by other federal and provincial government departments, as it remains relatively intact and undeveloped compared to other areas within coastal Nova Scotia. The ecological attributes of Port Joli align with three *Oceans Act* criteria for MPA establishment.

Table 4.6 Summary of the Port Joli Site Profile

***Oceans Act* Criteria (s.35)**	**Ecological Attributes**	**Human Uses**	**Current Protection and Research Initiatives**
(a) The conservation and protection of commercial and non-commercial fishery resources, including marine mammals, and their habitats; (b) The conservation and protection of endangered or threatened marine species, and their habitats; (d) The conservation and protection of marine areas of high biodiversity or biological productivity	• Herring spawning area at Little Hope Island • Abundance of invertebrates • Nursery area for pollock, herring, winter flounder, and other species • SARA species: Piping Plover • COSEWIC species: Atlantic cod • Intact marine environment with several adjacent terrestrial protected areas • Extensive salt marshes and eelgrass beds • Seal haul-outs • Birds: IBA, eelgrass habitat, shorebirds, important area for migratory birds, geese, dabbling ducks, bay ducks, sea ducks	• Fishing - lobster - herring roe • Rockweed and Irish moss harvesting (low levels) • Small scale fishing includes soft-shell clam and periwinkle harvesting • Moderate tourism and recreation • Low level of coastal development	• Recognized conservation importance among other federal and provincial departments • High level of protection on land • Research: - NaGISA - CPAWS-NS dive transects - NSNDR-DFO eelgrass project • CPAWS community engagement

4.4 LaHave River and Islands

LaHave River was originally an Acadian settlement and is one of the largest and best known rivers on the south shore of Nova Scotia. The LaHave River is recognized as an important area in Nova Scotia for recreational salmon fishing and for other anadromous fish, particularly the endangered Atlantic whitefish (SARA). The Petit Rivière watershed is likely the last place in the world where Atlantic whitefish are found. The area was identified as an important estuary in Atlantic Canada in a study by Environment Canada and is experiencing impacts from coastal development including industrial and residential development as the population of Bridgewater and neighbouring areas increase.

Location and Population

The LaHave River is located in southwest Nova Scotia near the town of Bridgewater in Lunenburg County (Service Nova Scotia 2006). There are several large and small islands at the mouth of the LaHave estuary, the largest of which are LaHave Island, Moshers Island, and Bush Island (*Ibid.*). The study area is approximately 216.6 km^2. See Figure 4.14 for the location map of LaHave River and Islands. The average population density of the area is 20-140 people per km^2 with a much higher density in Bridgewater of over 140 people per km^2 (Municipal Services 2001). Bridgewater is at the head of the estuary and is one of Nova Scotia's larger towns with a population of approximately 7,944 (Service Nova Scotia and Municipal Relations 2006).

Physical and Oceanographic Attributes

The LaHave River and Islands area is very similar to Mahone Bay, consisting of the same geological attributes and associated flora and fauna. Granite dominates the LaHave area. The area has many drumlins which form the mainland, islands, and shoals. Some of the islands are composed of slate forming headlands and other dominant terrestrial features (Davis and Browne 1996b).

The estuary has been classified as a complex mixed estuary in Greenlaw's (2008) fuzzy inlet classification. The estuary excluding the islands has an approximate area of 19.6 km^2 and a coastline of approximately 58.9 km (DFO 2007d). The estuary has a large watershed drainage area of 1741.6 km^2 and is strongly influenced by freshwater with a tidal to freshwater volume ratio of 27.1:1 (*Ibid.*). The estuary has a quick flushing time of 38.7 hours and a maximum depth of approximately 5.5 m (see Figure 4.13, DFO 2007d). The outer extent of the study area has a maximum depth of 54.9 m (CHS Chart 4012).

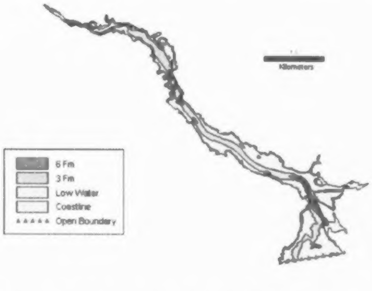
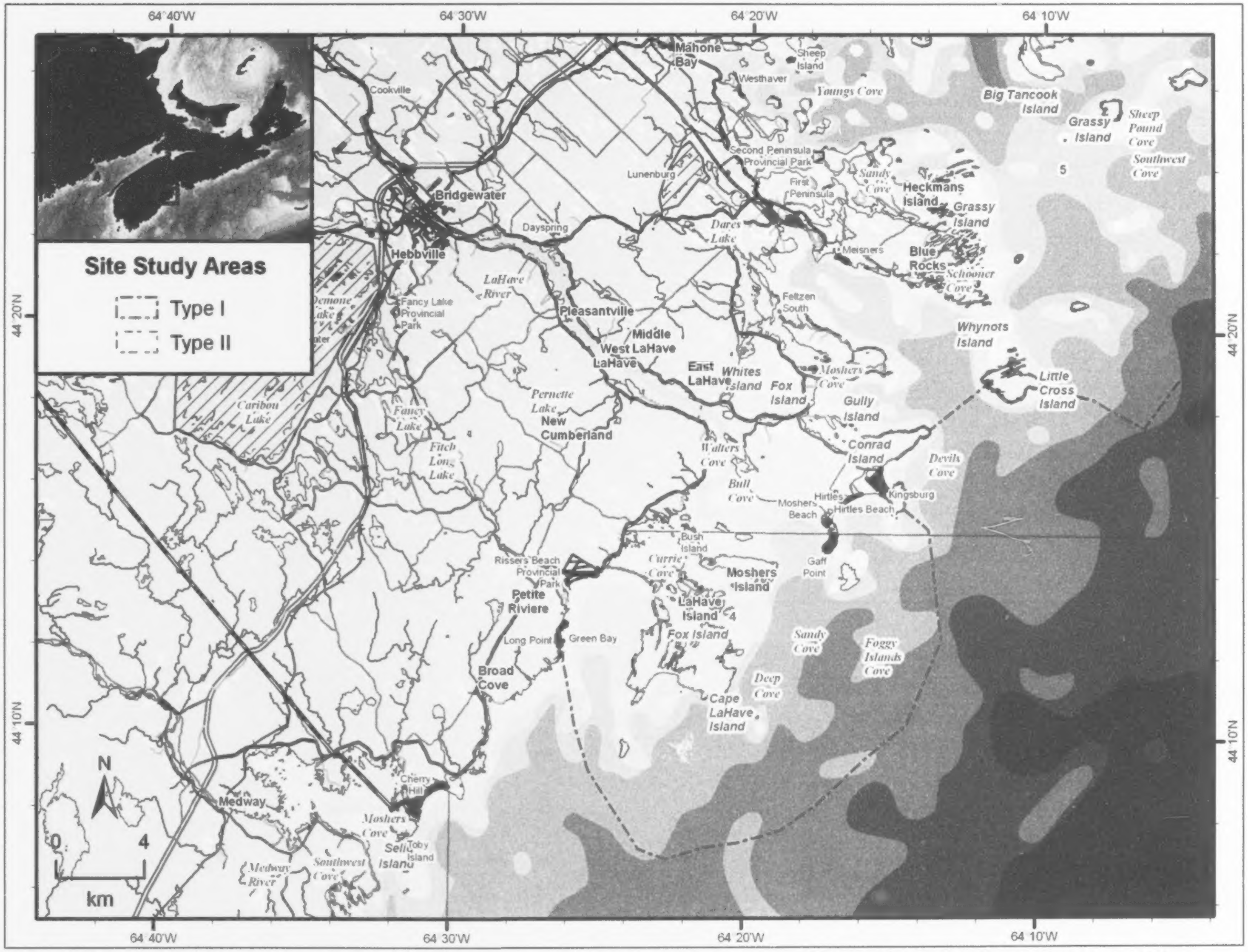


Figure 4.13 LaHave River Bathymetry (DFO 2007d) 1 Fm = 1.83 m, Coastline = intertidal zone

The landscape of the LaHave area was formed by drumlins that were carried by glaciers over 100 km from the north. Drumlin erosion has caused the formation of beaches, shoals, and tidal marshes (Lane and Associates 1992; Davis and Browne 1996b). Increased sediment supply combined with a varied coastline provides diversity of coastal habitats including rocky shores, cobble beaches, extensive sand beaches, tidal flats, and salt marshes (Davis and Brown 1996b). Some of these features are illustrated in Figure 4.15. The range in habitats results in a mix of northern and southern fauna and a diversity and abundance of waterfowl and seabirds. Most wetlands are tidal due to the lack of streams and lakes in the area. Most of the sediment is of local origin formed by glacial till. Many of the physical features and habitat types make the area highly sensitive to sea-level rise (NRCan 2007).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Site Study Areas
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Lunenburg
First Peninsula
Sandy Cove
Heckmans Island
Grassy Island
Bridgewater
Hebbville
Dayspring
Dares Lake
Meisners
Blue Rocks
Schooner Cove
LaHave River
Fancy Lake Provincial Park
Pleasantville
Feltzen South
Whynots Island
Middle West LaHave
LaHave
East LaHave
Whites Island
Fox Island
Moshers Cove
Little Cross Island
Gully Island
Caribou Lake
Fancy Lake
Pernette Lake
New Cumberland
Fitch Long Lake
Walters Cove
Conrad Island
Devils Cove
Bull Cove
Moshers Beach
Hirtles
Hirtles Beach
Kingsburg
Bush Island
Rissers Beach Provincial Park
Currie Cove
Moshers Island
Gaff Point
Petite Riviere
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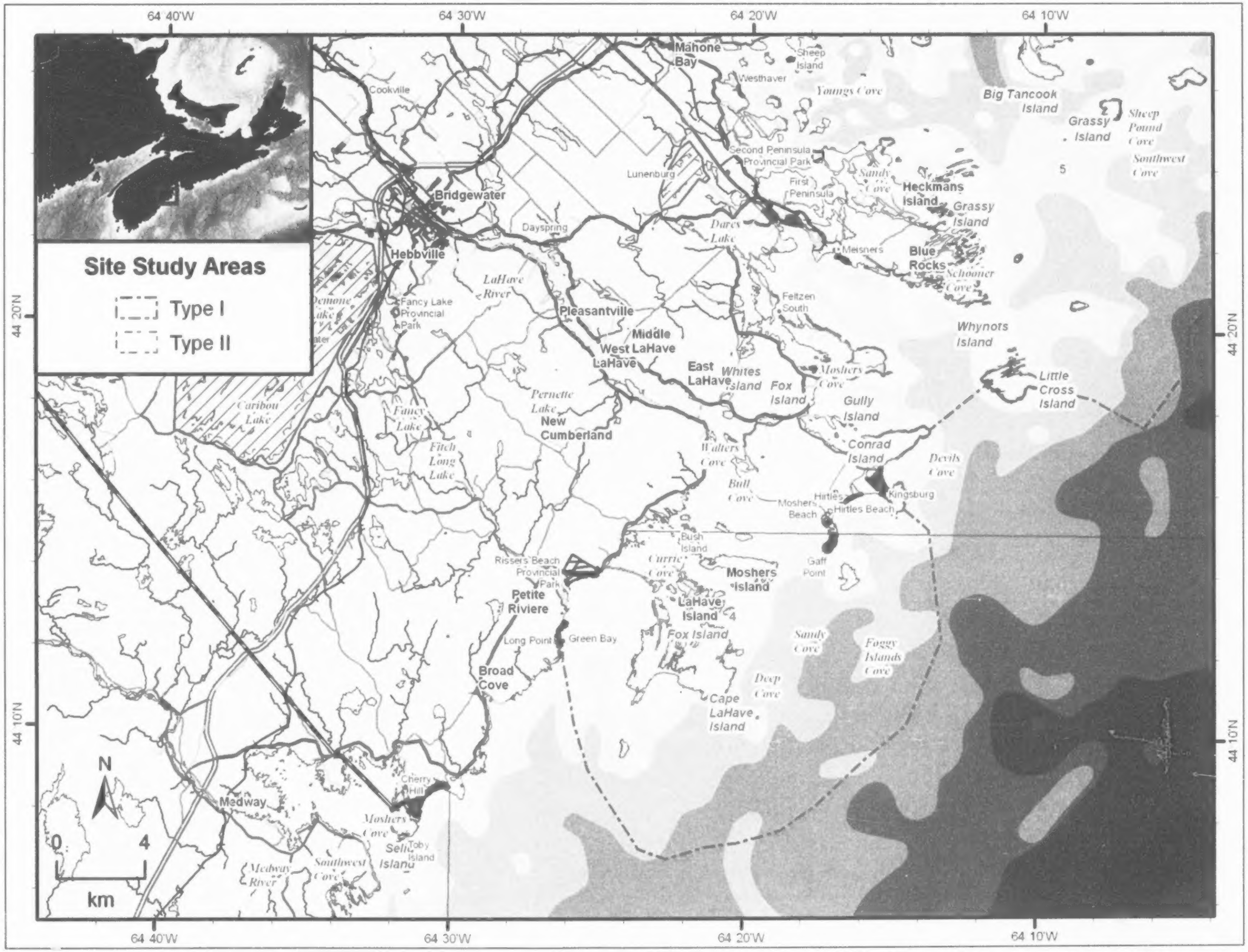
Cherry Hill
Medway
Moshers Cove
Toby Island
Selig Island
Medway River
Southwest Cove

Figure 4.14 Location Map for the LaHave River and Islands (Site #4). Basemap layers: land 1: 50 000, 1: 250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); Restricted and Limited Use Land Database Layers (NSDNR 2006b). Refer to Figure 4.1 for legend.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Pernette Lake
New Cumberland
Fitch Long Lake
Conrad Island
Walters Cove
Devils Cove
Bull Cove
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Hirtles Beach
Bush Island
Gaff Point
Rissers Beach Provincial Park
Currie Cove
Moshers Island
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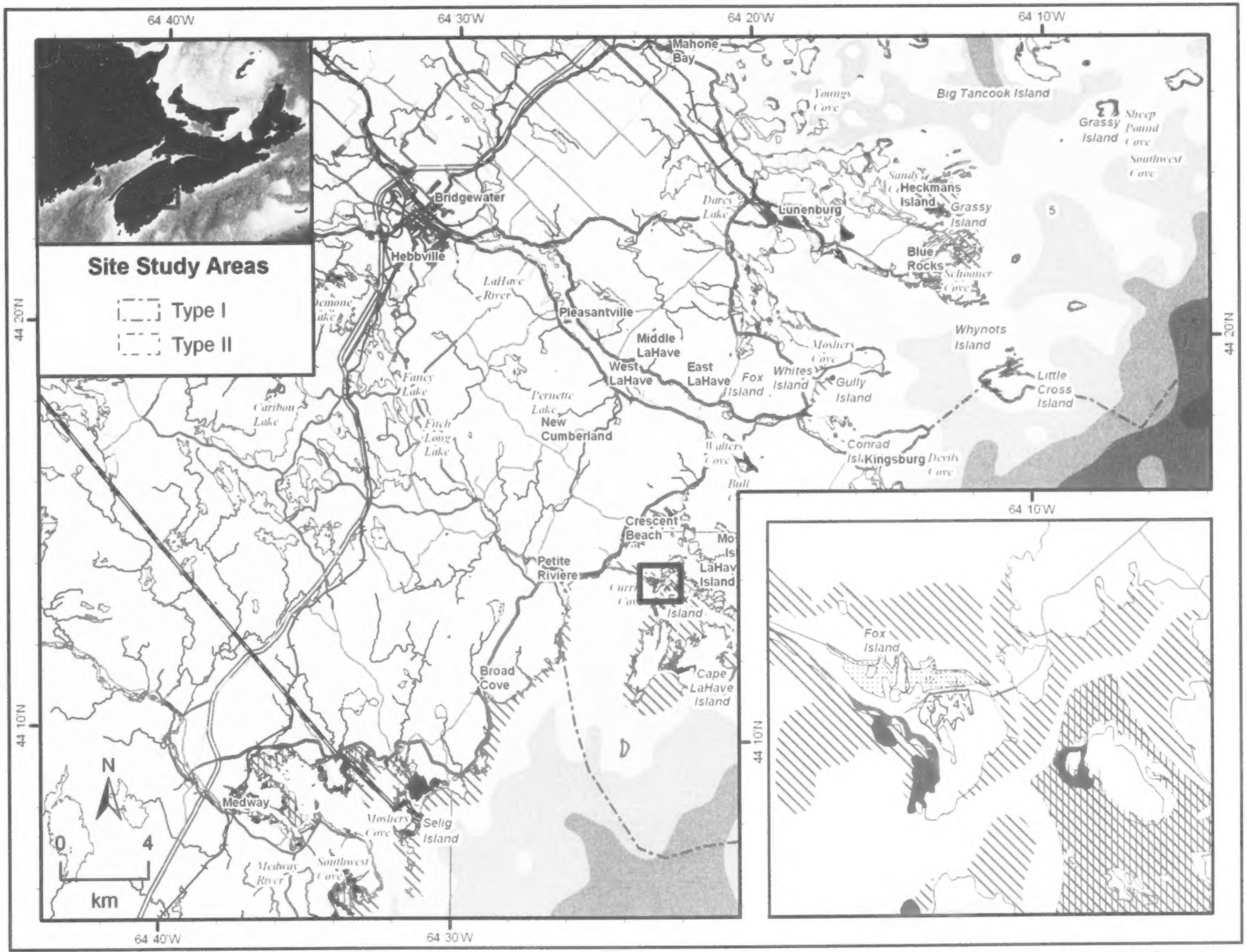
Figure 4.14 Location Map for the LaHave River and Islands (Site #4). Basemap layers: land 1: 50 000, 1: 250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); Restricted and Limited Use Land Database Layers (NSDNR 2006b). Refer to Figure 4.1 for legend.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Fox Island
Whites Island
Moshers Cove
Gully Island
Whynots Island
Little Cross Island
Fancy Lake
Caribou Lake
Fitch Long Lake
Pernette Lake
New Cumberland
Walters Cove
Conrad Island
Kingsburg
Devils Cove
Bull Cove
Crescent Beach
Petite Riviere
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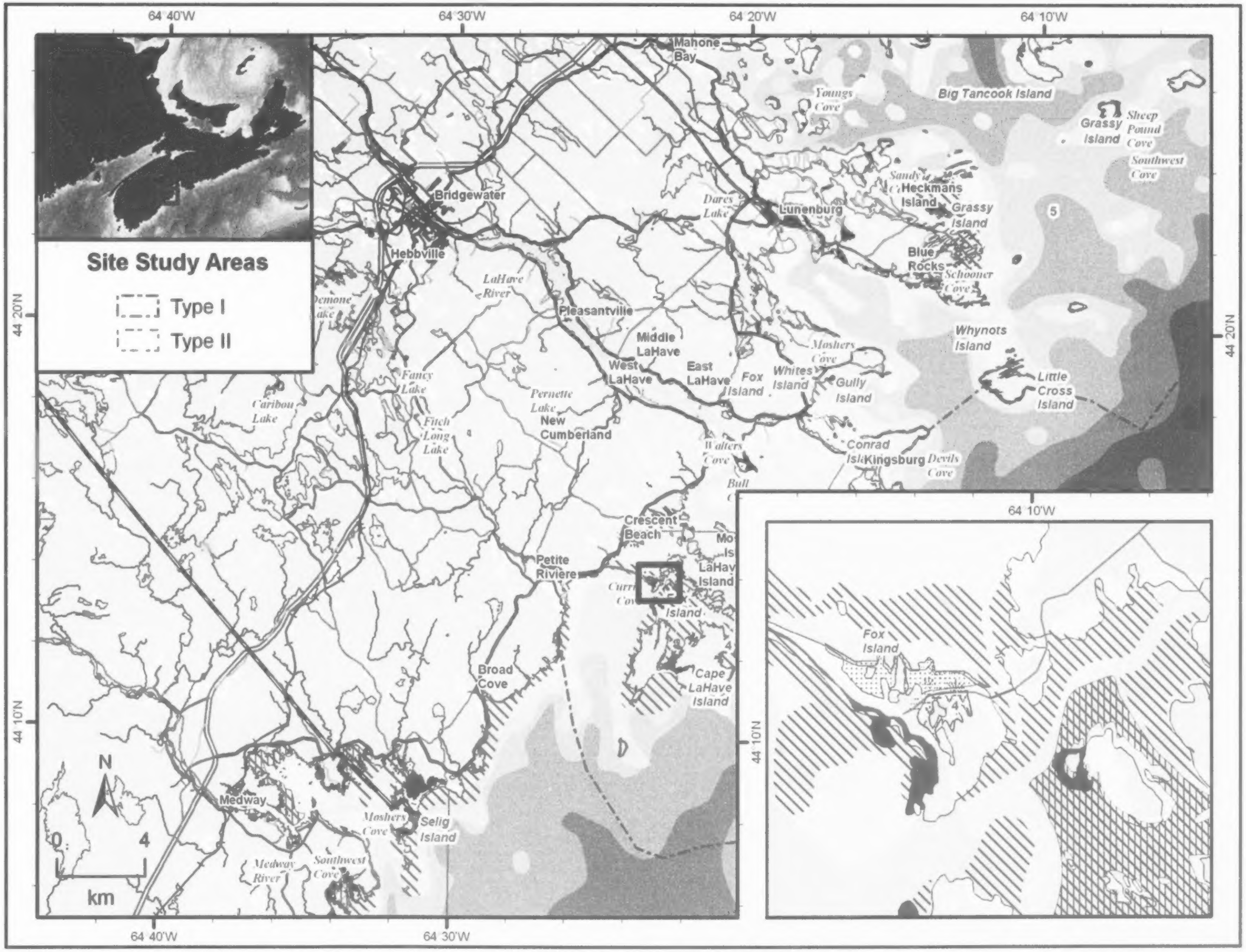
Figure 4.15 Coastal Habitats in the LaHave River and Islands (Site #4). Basemap layers: land 1:50 000, 1:250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); NSDNR Wetlands Database layers (NSDNR 2000). Refer to Figure 4.2 for legend.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Whites Island
Moshers Cove
Gully Island
Little Cross Island
Fancy Lake
Pernette Lake
New Cumberland
Caribou Lake
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Walters Cove
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Medway River
Southwest Cove
Fox Island
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Figure 4.15 Coastal Habitats in the LaHave River and Islands (Site #4). Basemap layers: land 1:50 000, 1:250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); NSDNR Wetlands Database layers (NSDNR 2000). Refer to Figure 4.2 for legend.

Ecological Attributes

The LaHave River and Islands area was identified by scientific experts as an EBSA. It meets the three primary EBSA criteria, uniqueness, aggregations, and fitness consequences, to a high degree and one of the secondary criteria (naturalness) to a medium degree (Doherty and Horsman 2007). The outer estuary was identified three times by scientific experts in the EBSA identification process and portions of the LaHave Islands area were identified four times (Doherty and Horsman 2007). The area was identified as an important estuary in Atlantic Canada in a study by Environment Canada (Bennett 2004).

The LaHave River and Islands area is primarily recognized as important habitat for anadromous fish including Atlantic salmon and the endangered Atlantic whitefish (SARA) (Bennett 2004; Doherty and Horsman 2007). The Petite Rivière watershed may support the only remaining population of Atlantic whitefish in the world (DFO 2008d). The river contains 870,854 m^2 of good salmon nursery habitat (Bennett 2004). There are several other commercial species that inhabit the LaHave Islands area including lobster, scallop, snow crab, shad, and the area is a bluefin tuna feeding area (Bennett 2004; Doherty and Horsman 2007; DFO 2005a).

The area is highly productive with extensive eelgrass, low and high salt marsh, and dense and diverse marine plants (Davis and Browne 1996b; Doherty and Horsman 2007; Bennett 2004; NSDNR 2000, Moore and Miller 1983).

This area was one of nine areas surveyed as part of the DFO-FSRS IEP fishery-independent survey (see boxed feature on page 18). Preliminary results indicate that, compared to the other sites, the LaHave gillnet catches had high species diversity and the highest catch rates of all the fishery-independent transects (DFO 2007c), however total catch from beach seines was low and species diversity average; catch from inshore lobster traps was above average but species diversity was average; and catch from transect lobster traps was above average, while species diversity was average. These different sampling methodologies indicate that in terms of overall productivity and diversity, LaHave has higher catch rates across most gears, but average species diversity (A. Bundy, DFO Science, unpublished data).

The area has a low to medium degree of naturalness, as demonstrated by the impacts to the area which are described in the following section on human uses and impacts. The area did not meet the EBSA criteria for naturalness in the EBSA identification process of the 2006 workshop (Doherty and Horsman 2007).

Bird Information

The LaHave River and Islands site overlaps with the northern half of the South Shore (East Queens County Sector) IBA (Number NS024). During the fall, Risser's Beach and surrounding areas are known as migration stopover sites for several species of shorebird species, namely Willet and Sanderling, and globally significant numbers of Semipalmated Plover (BLI 2009). The area also hosts nationally significant numbers of Piping Plover (endangered, SARA; CWS). Important, if not significant, colonies of Herring Gull, Great Black-backed Gull, Double-crested Cormorant, Common Tern, and Great Blue Heron are located within the area (CWS). High numbers of geese and very high numbers of dabbling ducks are found here, likely corresponding in part to high eelgrass densities. The outer LaHave River estuary and surrounding coastline host high to very high bay duck and very high sea duck numbers (CWS).

Important Marine Ecological Features:

- Important habitat for anadromous fish: Atlantic salmon and endangered Atlantic whitefish
- SARA-listed species: Atlantic whitefish (endangered) and Piping Plover (endangered)
- Variety of commercial species: lobster, scallop, snow crab, shad
- Bluefin tuna feeding area
- High diversity and abundance of fish species
- Extensive eelgrass beds and salt marshes
- Dense and diverse marine algae
- Birds: IBA(1), species at risk, shorebirds, eelgrass habitat, dabbling ducks, bay ducks, sea ducks

Human Uses

There are several human uses in the LaHave River and Islands area. Coastal development, especially industrial development, is a major human use affecting the watershed and marine area. Other human uses include fishing, aquaculture, recreation, and tourism. Marine plant harvesting occurs at low levels in the area. The entire area is leased to Acadian Seaplants Ltd. for rockweed harvesting (Justin Huston, Nova Scotia Fisheries and Aquaculture, pers. comm. 2009).

Coastal Development

Bridgewater has been experiencing an increase in population (Service Nova Scotia and Municipal Relations 2006) resulting in increased residential, commercial, and industrial development. The Town of Bridgewater has a comprehensive municipal planning strategy and associated land use bylaws. The surrounding Municipality of the District of Lunenburg has a municipal planning strategy but lacks land use bylaws (see Appendix D) (CBCL Limited 2009).

There is a significant amount of industrial development in the area. The Michelin tire plant (Michelin North America Inc.) discharges copper and zinc and copper and zinc compounds (0.01 and 0.09 tonnes of direct discharges) into the LaHave River, as reported in the National Pollutant Release Inventory (NPRI) (Environment Canada 2008b). The Morgan Falls Hydroelectric plant which began operation in 1996 has likely impacted the number of salmon and other anadromous fish going to and leaving their spawning areas. Studies conducted on hydroelectric stations in Nova Scotia for passage effectiveness of fish migrating upstream is 45-67% and maximum downstream passage effectiveness 59-78% (Federal Energy Regulatory Commission 2004).

Commercial Fishing

There are several different commercial fisheries in the LaHave River and Islands including groundfish, herring, mackerel, bluefin tuna, several species of crab, lobster, and scallops. These fisheries currently occur at low levels except crab which had moderate landings from 1999-2003 (DFO 2005a) although there were no landings reported between 2007 and 2009 (VDC 2009).

Crab landings are primarily Jonah crab, a moderately important commercial species, but may include rock crab which is often caught as bycatch in the lobster fishery and used as bait (M. Eagles, DFO Oceans, Habitat and Species at Risk Branch, pers. comm. 2010). There were moderate landings of herring from 2007-2009 directly south of the LaHave Islands (VDC 2009).

The lobster fishery in this area is of low importance at the provincial scale. In grid square 312, the reporting unit that most closely aligns with the study area, 2008 lobster landings are estimated at 182 MT. These landings comprise 0.61% of 2008 landings in DFO's Maritimes Region and 5.86% of LFA 33 landings in 2008. LFA 33 comprises 10% of 2008 landings in the Maritimes Region (VDC 2009).

Although commercial fishing is low in the study area, Yarmouth, Pubnico, Cape Sable and LaHave had the highest landed value for all species in Nova Scotia from 1991-2001, each making up 5% of total provincial landed values (CCN 2006). In 2001 69,087 tonnes of fish and shellfish with a value of $96,995,000 was landed in Lunenburg County (Interpretation Resources 2003). Currently there are four Small Craft Harbours, two fish processing plants, and one boat building facility in the area, indicating significant ties to the fisheries, either offshore or inshore (CCN 2006). It is presumed that the majority of fish landed are being caught outside the area, however, despite the low landings of most species, there are several species harvested commercially.

Past fisheries that were discussed by Bennett (2004) that have discontinued include:

- Gaspereau was fished but catches have significantly declined
- Four licenses for Jonah crab in LFA 33 – effort is concentrated along the northern edges of the LaHave Basin
- Primary location of shad landings in the Pennant Point to Pollock Point region
- Significant area for commercial quahog and mussels

There is also some fishing of salmon in the river. Agreements made in 2002 allow for the retainment of adipose clipped hatchery grilse by aboriginal communities in several rivers in NS including the LaHave and Mushamush Rivers (DFO 2003a). Table 4.7 below summarizes commercial fisheries in the LaHave study area.

Table 4.7 Summary of Major Commercial Fisheries and Gear Used in and Adjacent to the LaHave Estuary and Islands Area

Species	Landings*	Gear	Year	Source
Groundfish	L-M	Bottom longline / trawl	1999-2003 2007-2009	DFO 2005a VDC 2009
Herring	L-M	Mid-water gillnet	1999-2003 2007-2009	DFO 2005a VDC 2009
Mackerel	L	Mid-water gillnet	1999-2003 2007-2009	DFO 2005a VDC 2009
Bluefin tuna	L	Angling (hook and line)	1999-2003 2007-2009	DFO 2005a VDC 2009
Crab (Jonah and rock crab)	M	Pot	1999-2003	DFO 2005a
Scallop	L	Dredge	1999-2003	DFO 2005a
Lobster	L	Trap	2008	VDC 2009

*H = high, M = medium, L = low

Aquaculture

There are only two licenses in the immediate area, both are for blue mussels and are located along the north coast of Moshers Island (see Figure 4.16, Service Nova Scotia 2008). Sampling for the EMP has not occurred in the area (NSDFA 2006) and it is therefore uncertain if the licenses are in operation. The licenses comprise 0.12 km^2 and 0.6% of the study area.

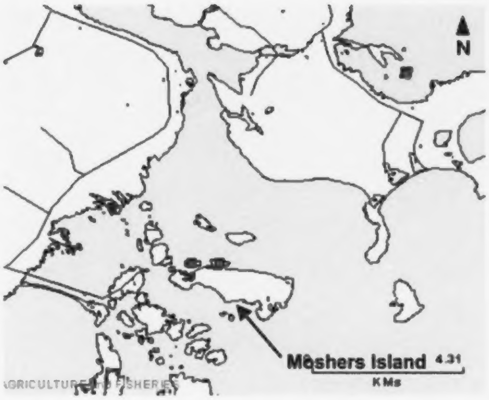


Figure 4.16 Aquaculture Licenses/Leases in the LaHave Islands Area (denoted by green squares) (Service Nova Scotia 2008)

Tourism, Recreation, and Culture

The LaHave River has historically been important for several human activities including shipping, recreational boating and industrial uses (Bennett 2004) and was also an Acadian settlement (Lane and Associates 1992). Currently, other services, business services, and retail trade make up the majority of industries in the area (Statistics Canada 2008). Michelin Tire is Nova Scotia's largest manufacturing employer and has a dominating presence in the county (Interpretation Resources 2003). There are also several different fisheries in the area, however, the dominant drivers of the local economy are industry and retail. The area draws tourists, although there are fewer ecotourism outlets and recreational opportunities compared to nearby Mahone and St. Margaret's Bay.

The islands are a popular area for recreational boating and there are beaches which draw tourists in the summer. LaHave is known as one of the best rivers for recreational salmon fishing along the Atlantic coast (Nova Scotia Salmon Association 2009). There is a yacht club and there are a few recreational operators, including Sea Kayak Adventures on LaHave Island and Halifax Canoe in LaHave.

Current Protection and Research/Conservation Initiatives

There is some terrestrial protection in the area including Rissers Beach Provincial Park, Hirtle's Beach (Non-designated Park Reserve), Long Point and Green Bay Protected Beaches, and Nature Conservancy of Canada Lands (50 ha) at Gaff Point (NSDNR 2006b; NCC 2009). There is also a small parcel of land that was donated to the Nova Scotia Nature Trust (NSNT) at Gaff Point (4.86 ha) (NSNT 2009). These areas comprise a very small portion of the overall area.

The ecological importance of this area was recognized in a report by Lane and Associates (1992) that identified the Cape LaHave Islands area, among 16 others, as a potential site of significance during an initial scoping exercise. Lane and Associates (1992) later dropped the area prior to making its recommendations to Parks Canada. Parks Canada is not currently pursuing an NMCA designation in the Scotian Shelf marine region.

The Bluenose Coastal Action Foundation (BCAF) is undertaking an Atlantic whitefish recovery project in the Petite Rivière watershed along with the Atlantic Whitefish Conservation and Recovery Team (AWCRT), which is comprised of Fisheries & Oceans Canada, Nova Scotia Departments of Agriculture and Fisheries and Natural Resources, together with other levels of government, community groups and individuals and promotes stewardship while undertaking recovery efforts. Water quality monitoring of the LaHave River and watershed is also being conducted by the BCAF (Environment Canada 2008a).

Research was recently completed in the area and more ecological information will be available upon publication of results from the Fishery-Independent Survey completed in 2006 as part of the DFO-FSRS IEP (see boxed feature on page 18). This survey involved transect sampling of nine sites in Nova Scotia, one of which was the LaHave area (DFO 2006a). Further, results of the analysis of LEK surveys of commercial fish harvesters which was also completed as part of the IEP in 2006, will contribute to the understanding of the ecological significance of the area. The work is expected to be published in 2009 and will address some of the data gaps (A. Bundy, DFO Science Branch, pers. comm. 2009).

Summary

Table 4.8 below summarizes the key information provided in the site profile. The LaHave River and Islands area may have a high diversity and abundance of marine species, which is well represented by the variety of species caught in the area commercially. The area has several important ecological attributes which may be impacted by the high level of coastal development due to the high population of Bridgewater. The ecological attributes of the area align with three *Oceans Act* criteria for MPA establishment.

Table 4.8 Summary of the LaHave River and Islands Site Profile

***Oceans Act* Criteria (s.35)**	**Ecological Attributes**	**Human Uses**	**Current Protection and Research Initiatives**
(a) The conservation and protection of commercial and non-commercial fishery resources, including marine mammals, and their habitats; (b) The conservation and protection of endangered or threatened marine species, and their habitats (d) The conservation and protection of marine areas of high biodiversity or biological productivity	• Important area for anadromous fish: Atlantic salmon and Atlantic whitefish • Bluefin tuna feeding area • Variety of commercial species: lobster, scallop, snow crab, shad • High diversity and abundance of fish species • SARA species: Atlantic whitefish and Piping Plover • Extensive salt marshes and eelgrass beds • Dense and diverse marine algae • Birds: IBA (1), shorebirds, eelgrass habitat, dabbling ducks, bay ducks, sea ducks	• Fishing - several species of crab - scallops - lobster - herring - groundfish - mackerel - bluefin tuna • Shellfish aquaculture • Rockweed harvesting • Minimal tourism • Recreation: boating, salmon fishing • High coastal development: residential and industrial	• Adjacent terrestrial protection is minimal • Some interest from provincial departments for protection of coastal lands • Current research and conservation initiatives: • IEP (LEK mapping and fishery-independent surveys) • BCAF whitefish recovery

4.5 Mahone Bay

Mahone Bay is well known for its cultural significance due to a long history of fishing. Lunenburg was Atlantic Canada's first UNESCO World Heritage Site and is home to the Bluenose schooner, a national icon. Several toursist attractions including museums, shopping, and ecotourism and recreation operations draw in several tourists each year. The area boasts several species of birds which are drawn to this productive marine environment which contains a diversity of habitats. The area is well-known for the numerous drumlin islands which provide habitat for several species including the endangered Roseate Tern (SARA).

Location and Population

Mahone Bay is a large bay located approximately 80 km southwest of Halifax in Lunenburg County on the South Shore of Nova Scotia (Service Nova Scotia 2006). The study area is approximately 563.6 km^2 and encompasses Lunenburg Harbour and Mahone Bay and some islands outside of the bay. See Figure 4.18 for a location map of Mahone Bay. There are two towns in the area, Lunenburg and Mahone Bay, with respective populations of 2317 and 904 (Service Nova Scotia and Municipal Relations 2006). The average population density of the area is approximately 20-140 people per km^2, with the two towns having a higher density (Municipal Services 2001).

Physical and Oceanographic Attributes

The dominant rock type in Mahone Bay is granite (Davis and Browne 1996b). The bay is bathymetrically complex consisting of shoals and bedrock sills surrounding two deep basins and 365 drumlin islands (CPAWS-NS 2008). The bay has two deep basins with a maximum depth of 62 m in the northwest basin (See figure 4.17, DFO 2007d). The outer extent of the study area has a maximum depth of 73.2 m (CHS Chart 4012). Temperatures in Mahone Bay are slightly warmer than those of similar inlets, such as St. Margaret's Bay, likely as a result of the sheltered effect caused by the sills and numerous islands (Bennett 2004).

The large, semi-enclosed bay has been classified as an intermediate pelagic bay (Greenlaw 2009) with a total area of approximately 209 km^2 and a coastline of approximately 138 km (DFO 2007d). The bay has a watershed drainage area of 1390.8 km^2 (DFO 2007d).

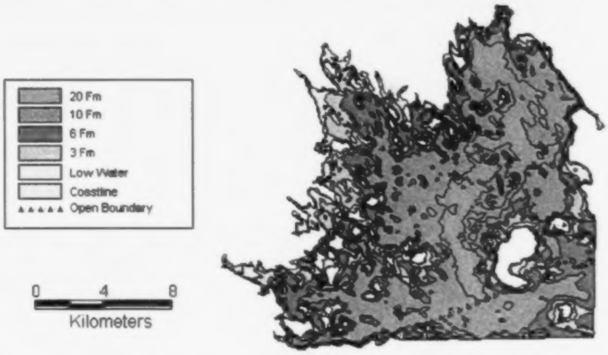
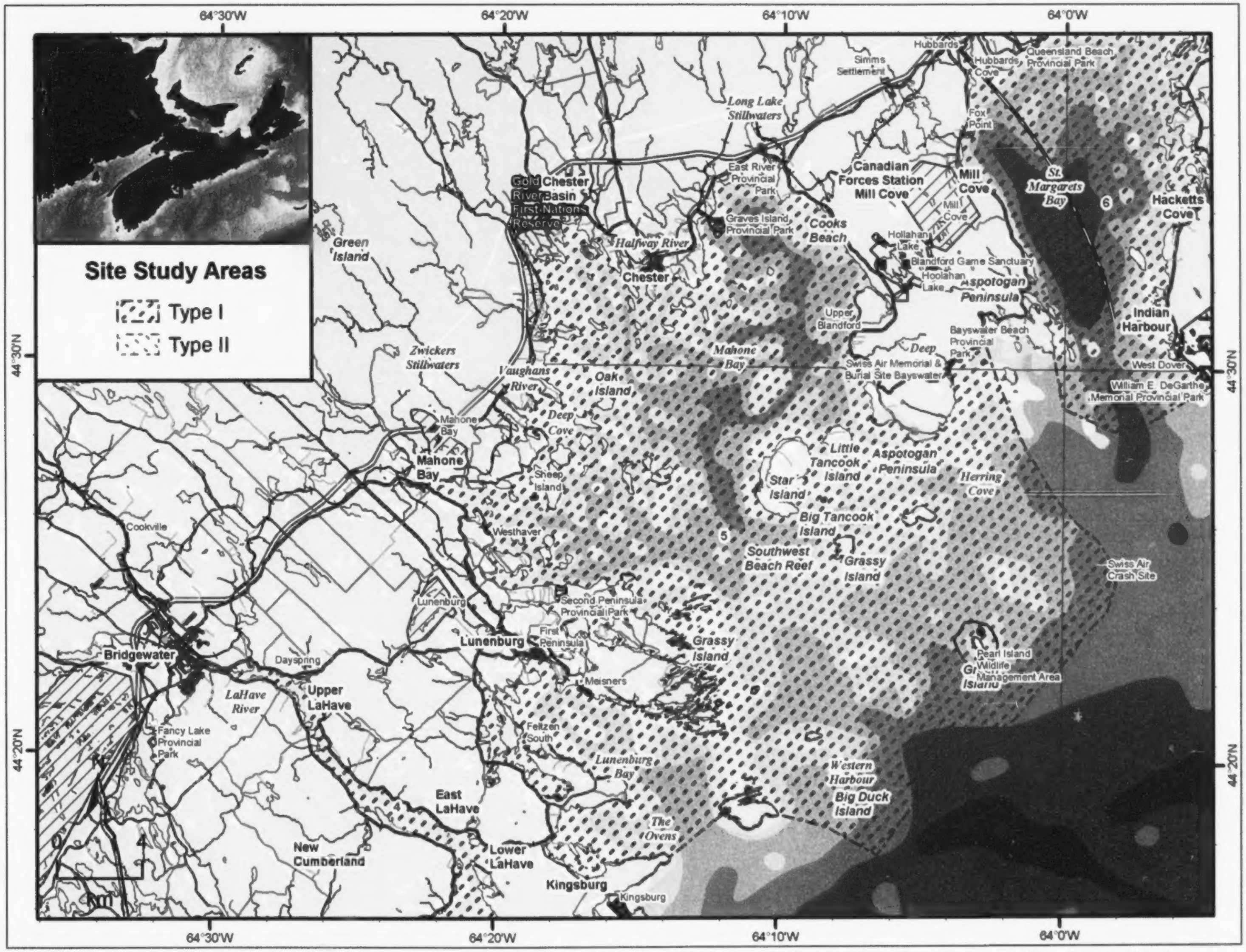


Figure 4.17 Mahone Bay Bathymetry (DFO 2007d)
1 Fm = 1.83 m, Coastline = intertidal zone

The landscape of Mahone Bay was formed by drumlins that were carried by glaciers over 100 km from the north (Davis and Brown 1996b). Increased sediment supply combined with a varied coastline provides diversity of coastal habitats including rocky shores, cobble beaches, extensive sand beaches, tidal flats, and salt marshes. Many of these features were created by drumlin erosion. Some of these features are illustrated in Figure 4.19. The range in habitats results in a mix of northern and southern fauna and a diversity and abundance of waterfowl and seabirds (Davis and Brown 1996b). Drumlin formations are sheltered from erosion by bedrock ridges (Bennett 2004). The area is considered highly sensitive to sea-level rise (NRCan 2007).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Site Study Areas
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Gold River First Nations Reserve
Chester Basin
Chester
Halfway River
Green Island
Long Lake Stillwaters
Simms Settlement
Hubbards
Hubbards Cove
Queensland Beach Provincial Park
Fox Point
East River Provincial Park
Graves Island Provincial Park
Canadian Forces Station Mill Cove
Cooks Beach
Mill Cove
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Hollahan Lake
Blandford Game Sanctuary
Aspotogan Peninsula
Upper Blandford
Indian Harbour
Bayswater Beach Provincial Park
Deep Cove
Swiss Air Memorial & Burial Site Bayswater
West Dover
William E. DeGarthe Memorial Provincial Park
Zwickers Stillwaters
Vaughans River
Oak Island
Mahone Bay
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Star Island
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Herring Cove
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Swiss Air Crash Site
Westhaver
Cookville
Lunenburg
Second Peninsula Provincial Park
First Peninsula
Grassy Island
Pearl Island Wildlife Management Area
Green Island
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Dayspring
LaHave River
Upper LaHave
Meisners
Fancy Lake Provincial Park
Feltzen South
Lunenburg Bay
Western Harbour
Big Duck Island
East LaHave
The Ovens
New Cumberland
Lower LaHave
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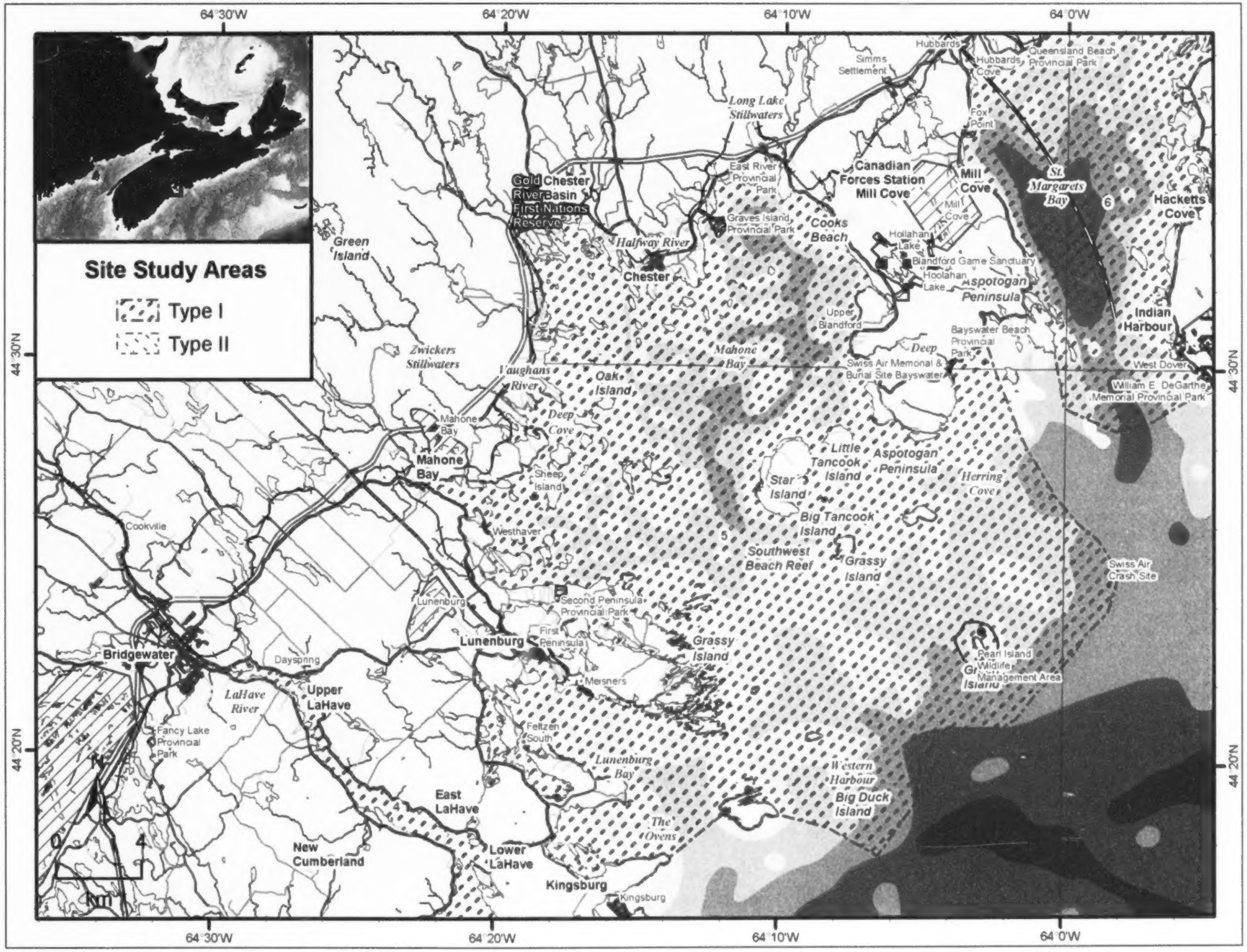
km

Figure 4.18 Location Map for Mahone Bay (Site #5). Basemap layers: land 1: 50 000, 1: 250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); Restricted and Limited Use Land Database Layers (NSDNR 2006b). Refer to Figure 4.1 for legend.


64°30'W
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Site Study Areas
Type I
Type II
Hubbards
Queensland Beach Provincial Park
Hubbards Cove
Simms Settlement
Long Lake Stillwaters
Fox Point
St. Margarets Bay
6
Hacketts Cove
East River Provincial Park
Canadian Forces Station Mill Cove
Mill Cove
Gold River First Nations Reserve
Chester Basin
Graves Island Provincial Park
Cooks Beach
Hollahan Lake
Blandford Game Sanctuary
Hoolahan Lake
Aspotogan Peninsula
Green Island
Halfway River
Chester
Upper Blandford
Indian Harbour
Bayswater Beach Provincial Park
Deep
Zwickers Stillwaters
Mahone Bay
Swiss Air Memorial & Burial Site Bayswater
West Dover
Vaughans River
Oak Island
William E. DeGarthe Memorial Provincial Park
Deep Cove
Mahone Bay
Little Tancook Island
Aspotogan Peninsula
Herring Cove
Sheep Island
Star Island
Big Tancook Island
Cookville
Westhaver
5
Southwest Beach Reef
Grassy Island
Swiss Air Crash Site
Lunenburg
Second Peninsula Provincial Park
First Peninsula
Lunenburg
Grassy Island
Bridgewater
Dayspring
Pearl Island Wildlife Management Area
Meisners
LaHave River
Upper LaHave
Fancy Lake Provincial Park
Feltzen South
Lunenburg Bay
Western Harbour
Big Duck Island
East LaHave
4
The Ovens
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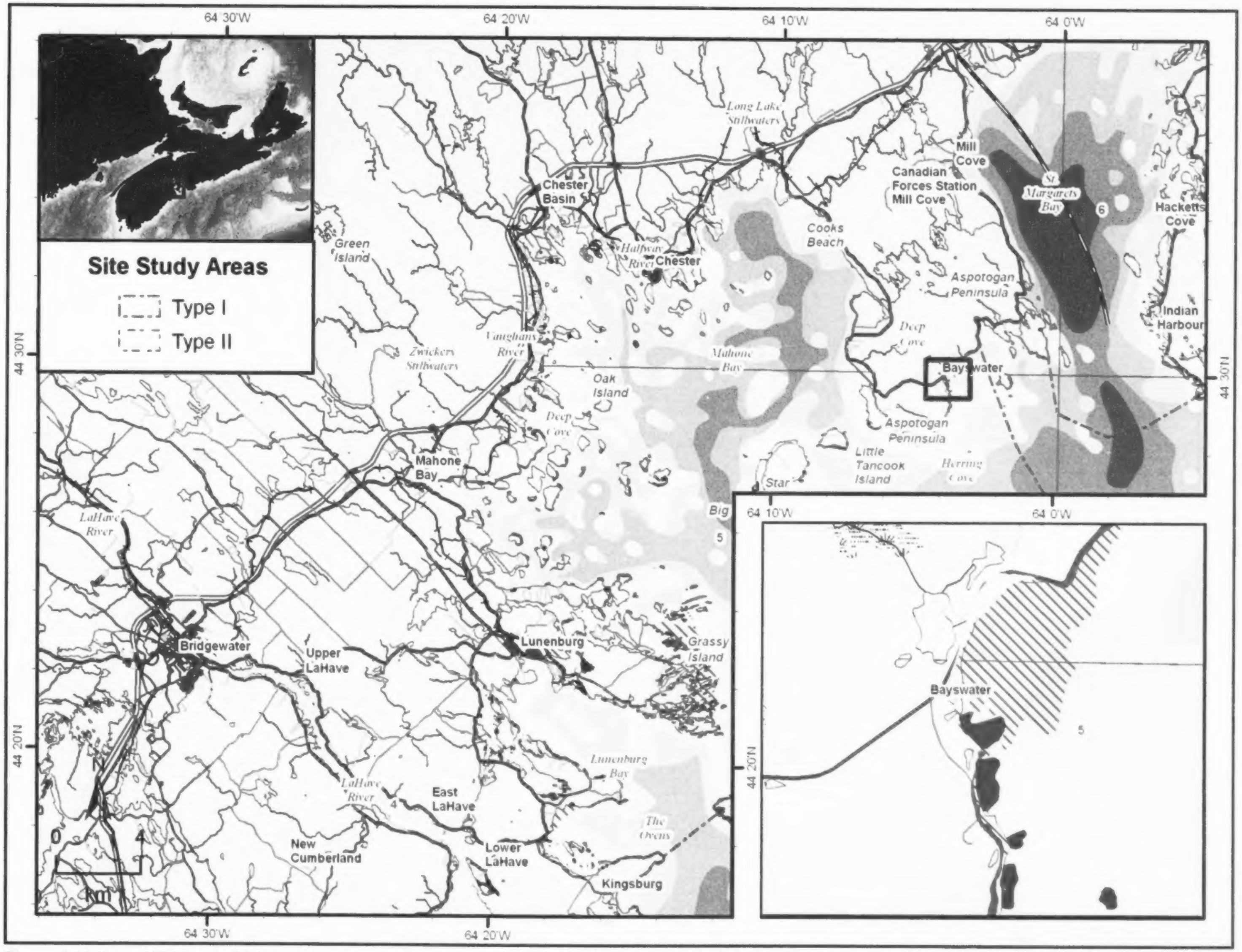
km
New Cumberland
Lower LaHave
Kingsburg
Kingsburg

Figure 4.18 Location Map for Mahone Bay (Site #5). Basemap layers: land 1: 50 000, 1: 250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); Restricted and Limited Use Land Database Layers (NSDNR 2006b). Refer to Figure 4.1 for legend.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64 0'W
44 30'N
44 20'N
Long Lake Stillwaters
Mill Cove
Canadian Forces Station Mill Cove
St. Margarets Bay
6
Hacketts Cove
Chester Basin
Green Island
Halfway River
Chester
Cooks Beach
Aspotogan Peninsula
Indian Harbour
Deep Cove
Vaughans River
Zwickers Stillwaters
Mahone Bay
Bayswater
Oak Island
Deep Cove
Aspotogan Peninsula
Little Tancook Island
Herring Cove
Star
Mahone Bay
Big
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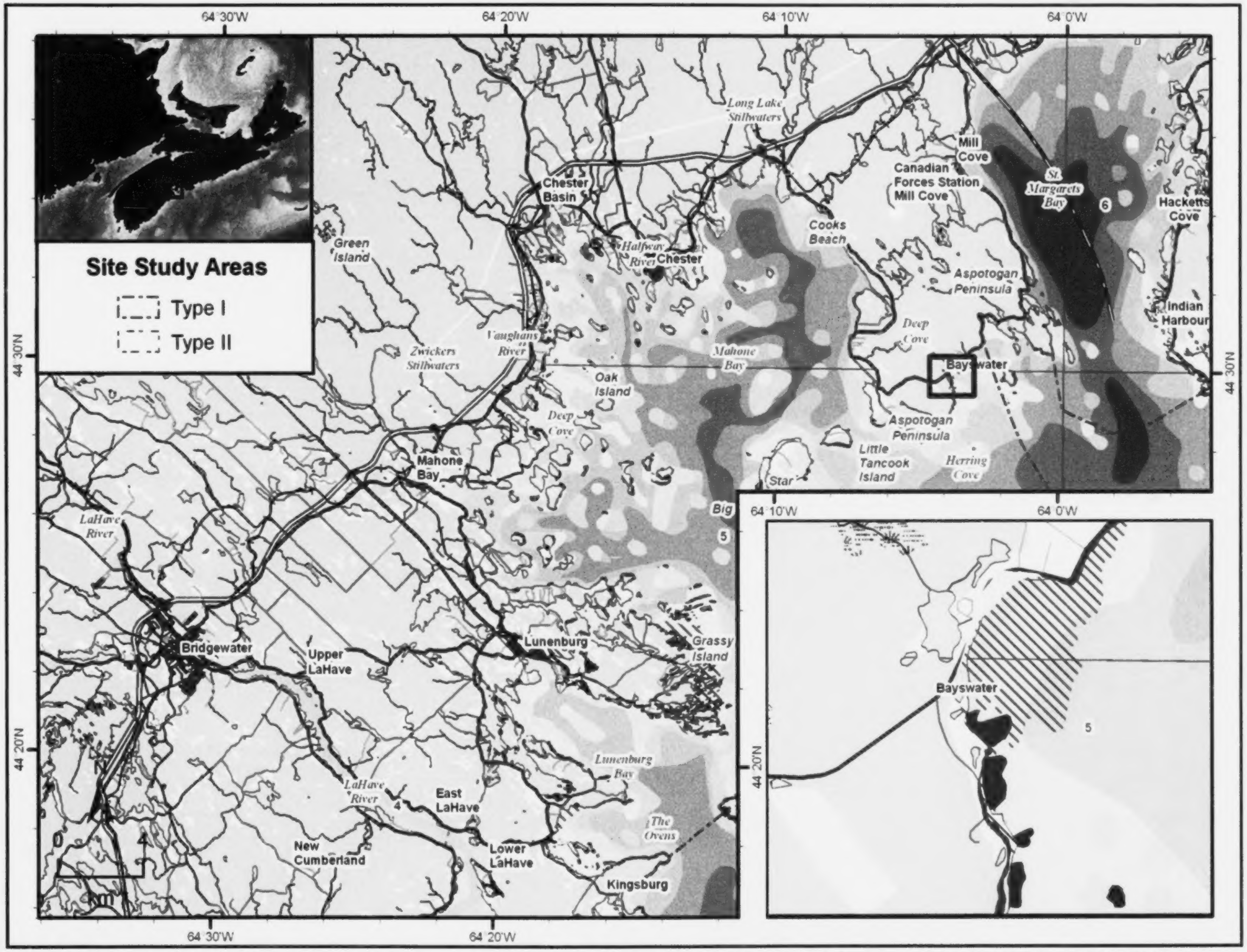
LaHave River
Bridgewater
Upper LaHave
Lunenburg
Grassy Island
Lunenburg Bay
LaHave River
4
East LaHave
The Ovens
New Cumberland
Lower LaHave
Kingsburg
0
4
km
Bayswater
5

Figure 4.19 Coastal Habitats in Mahone Bay (Site #5). Basemap layers: land 1:50 000, 1:250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); NSDNR Wetlands Database layers (NSDNR 2000). Refer to Figure 4.2 for legend.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East LaHave
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Figure 4.19 Coastal Habitats in Mahone Bay (Site #5). Basemap layers: land 1:50 000, 1:250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); NSDNR Wetlands Database layers (NSDNR 2000). Refer to Figure 4.2 for legend.

Ecological Attributes

Mahone Bay was identified by scientific experts as an EBSA as it meets all of the primary and secondary EBSA criteria with a high value for aggregations (Doherty and Horsman 2007). The area was identified three times by scientific experts in the EBSA identification process (although the outer islands were identified four times). Other areas were identified for ecological significance by up to five experts (*Ibid.*).

Mahone Bay is well-known for its numerous islands which create sheltered areas within the bay and provide a diversity of habitat for several marine and bird species. Pollock spawn in the bay and juvenile pollock, hake, and sand lance can be found taking refuge in areas of the bay (McCullough *et al.* 2005; Bundy *et al.* 2007; O'Connor 2008). Northern shrimp potentially spawn in the bay (Koeller 2000). Chedabucto, Mahone, and St. Margaret's Bay are known inshore areas for populations of Northern shrimp (Koeller 2000; Koeller *et al.* 2007 *In* Bundy *et al.* 2007). There are aggregations of seals around the shoals (Doherty and Horsman 2007) and the area has extensive habitat suitable for lobster throughout the bay as well as scallop beds concentrated near Indian Point (Bennett 2004). The area is a former bluefin tuna feeding area. Bluefin tuna landings were once concentrated in the Lunenburg/LaHave area (Bennett 2004).

The bay is productive with scattered eelgrass beds and high and low salt marsh mostly in the western portion of the bay (Doherty and Horsman 2007; NSDNR 2000). The area has dense and healthy macrophyte beds near the mouth of the bay (Doherty and Horsman 2007) and has a relatively high abundance of Irish moss (Sharp *et al.* 2008).

The area has a low to medium level of naturalness (Doherty and Horsman 2007) as there are high levels of residential and industrial development as well as aquaculture (Municipal Services 2001; Bennett 2004; Lane and Associates 1992). The bay experiences ongoing shellfish harvesting closures. There are higher quantities of the invasive green crab compared to other sites in this analysis (31.5 crabs per trap haul) (Bundy *et al.* 2007). Other invasive species include the vase tunicate *C. intestinalis* which has experienced population explosions (Nicolas 2007 *In* DFO 2007c), *Membranipora membranacea* (bryozoan), *Ciona intestinales* (sea squirt), and *Codium fragile* (Bennett 2004).

Bird Information

This area does not coincide or otherwise overlap with presently identified IBAs, although during the breeding season the area is home to several marine bird colonies representing important diversity (approximately 13 species; CWS). In particular, the Grassy Island complex is known to have hosted nationally significant numbers of Roseate Tern (endangered, SARA; CWS). Although Roseate Tern numbers are not presently at the level required for IBA designation, criteria have been met in the past, and these criteria are being revisited. CWS marine bird colony data also suggest that Common Tern, Herring Gull, and Great Black-backed Gull numbers also can reach nationally significant levels (CWS). The area south of Lunenburg can host high numbers of geese and dabbling ducks. Eelgrass densities are also high here. Bay ducks can be found here in high to very high numbers in southern and western areas while very high sea duck numbers are recorded in the deeper outer bay waters (CWS).

Important Marine Ecological Features:

- Spawning area for pollock and Northern shrimp
- Nursery area for juvenile pollock, sand lance, and hake
- Former bluefin tuna feeding area
- Seal aggregations around shoals
- Scattered but dense eelgrass beds and salt marshes
- Dense and healthy marine plant beds with abundant Irish moss
- SARA-listed species: Roseate Tern (endangered)
- Birds: species at risk, colonies, bay ducks, sea ducks

Human Uses

Human uses in Mahone Bay include coastal development, aquaculture, fishing, tourism, and recreation. There are two submarine cables that come to shore, one at Lunenburg and one between Blandford and Tancook Island (DFO 2005a). There is also one marine plant harvesting lease for rockweed that comprises the entire bay, however, harvested quantities are minor compared with landings in other areas of the province, namely Lobster Bay (Justin Huston, Nova Scotia Fisheries and Aquaculture, pers. comm. 2009).

Coastal Development

The bay has a high amount of residential development in and around the towns of Lunenburg, Mahone Bay, and Chester. The Municipality of the District of Chester on the east of Mahone Bay has a comprehensive municipal planning strategy and associated land use bylaws, however the Municipality of the District of Lunenburg has a municipal planning strategy but lacks land use bylaws (see Appendix D) (CBCL Limited 2009).

Coastal industries include High Liner Foods Inc., a fish processing plant; Reinforced Plastic Systems Inc., a plastic producer; and Louisiana Pacific Canada Ltd. which produces wood products (Bennett 2004). Dredging of Lunenburg Harbour has occurred and likely continues. Mahone Bay experiences shellfish closures on a regular basis. The majority of the bay, including Lunenburg Bay, was closed to bivalve and gastropod harvesting on January 21, 2009 due to bacteriological contamination (DFO 2009f).

Commercial Fishing

Mahone Bay is historically significant for the scallop fishery; Lunenburg was one of the first areas in Nova Scotia to develop the fishery. Mahone Bay and Digby were home to the leading inshore fisheries until 1945 (Bennett 2004). As of 1998, there were 34 commercial and 310 recreational scallop licenses issued for Lunenburg County (Bennett 2004). Areas closed to scallop fishing since 1995 are in the coastal zone of the Second Peninsula and waters near Bayport in Lunenburg Harbour (Bennett 2004). In 2006, scallop fishing occurred at the mouth of Mahone Bay (DFO 2008b).

Although the scallop fishery has been minimal in recent years, Mahone Bay is now an important mackerel area where a moderate amount of landings are caught by trap net and gillnet (DFO 2005a;

VDC 2009). A small experimental fishery for northern shrimp occurred in Mahone Bay since commercial quantities were discovered in 1997 (DFO 2002b) but there are currently no recorded landings in the area. The last recorded landings of any significance were in 2001 and there are currently only four license holders in the area (M. Eagles, DFO Oceans, Habitat and Species at Risk Branch, pers. comm. 2010).

Lobster landings are relatively low in Mahone Bay compared to other areas in this report. In grid squares 314, 315 and 316, the reporting units that most closely align with the study area, 2008 lobster landings are estimated at 179 MT. These landings comprise 0.60% of 2008 landings in DFO's Maritimes Region and 5.74% of LFA 33 landings in 2008. LFA 33 comprises 10% of 2008 landings in the Maritimes Region (VDC 2009).

Mahone Bay has more Small Craft Harbours than any other study area in this analysis and also has several other public and private wharves, most of which are used for recreation. There are four fish processing plants and three boat building facilities in the area (CCN 2006).

Table 4.9 below summarizes commercial fisheries is Mahone Bay.

Table 4.9 Summary of Major Commercial Fisheries and Gear Used in and Adjacent to Mahone Bay

Species	Landings*	Gear	Year	Source
Mackerel	M	Trap net, mid-water gillnet	1999-2003 2007-2009	DFO 2005a VDC 2009
Lobster	L	Trap	2008	VDC 2009
Scallop	L	Dredge	1999-2003 2007-2009	DFO 2005a VDC 2009

*H = high, M = medium, L = low

Aquaculture

Mahone Bay has a high concentration of aquaculture operations, with lease areas taking up 1.07 km^2 or 0.19% of the study area. There are 25 licenses directly within Mahone Bay and 2 in adjacent areas (see Figure 4.20, Service Nova Scotia 2008). Mahone Bay is well-known for being a major contributor to aquaculture in Nova Scotia, especially for blue mussels and other shellfish (Canadian Aquaculture Industry Alliance 2008).

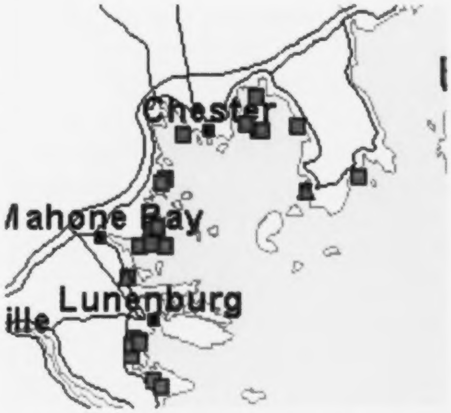


Figure 4.20 Aquaculture Licenses/Leases in Mahone Bay (denoted by green squares) (Service Nova Scotia 2008)

Tourism, Recreation, and Culture

Mahone Bay draws numerous tourists, seasonal residents, and retirees to its shores and has a diversified economy which consists primarily of fishing, tourism, processing and manufacturing (Interpretation Resources 2003). In addition to the two major towns of Lunenburg and Mahone Bay are the Acadian First Nation, which is located on the coast (Gold River Reserve near Chester), and the Indian River First Nations Reserves located further inland (Interpretation Resources 2003).

There are several coastal/marine ecotourism operators including: Searover Adventure Tours (boat tours, kayak rentals, fishing charters, and SCUBA diving), Lunenburg Ocean Adventures (shark fishing, dive charters), Lobsterman boat tours (lobster fishing, seal and bird watching), Mahone Bay Kayak Adventures, Discovery Sailing Charters, Sail Mahone Bay, Sou'Wester Adventures (sailing), Sail Charters Ltd, and Lunenburg Whale Tours. There are also fishing charter operators including Nature's Point of View Outdoor Adventures (Adventure Nova Scotia 2009). Small cruise ships visit Lunenburg occasionally (DFO 2005a). The Fisheries Museum of the Atlantic in Lunenburg is a major tourist attraction and is a docking location for the Bluenose II.

Current Protection and Research/Conservation Initiatives

There are several small terrestrial protected areas in the bay: Graves Island Provincial Park, Pearl Island WMA (includes a marine component), Sheep Island (NCC land), Meisners Protected Beach, Blandford Game Sanctuary (not directly adjacent to coast) (NSDNR 2006b) and the Blandford Nature Reserve (NSE 2009b), and Grassy Island WMA (includes a marine component) (Service Nova Scotia 2006). NCC is in the process of acquiring 364 ha in Deep Cove near the Blandford Nature Reserve (NCC 2009). Deep Cove was identified as an ecologically significant site for its presence of rare lichens and important landscape (*Ibid.*). The Little Gooseberry Island Conservation Easement in Mahone Bay is 11.33 ha of land that was donated to NSNT (NSNT 2009).

The Canadian Parks and Wilderness Society has been advocating for a Parks Canada National Marine Conservation Area (NMCA) in the area for years, although this is not one of Parks Canada's priority areas (CPAWS-NS 2008). The Mahone Islands Conservation Association is a group of local residents who are concerned about the impacts of increasing coastal development to the integrity of the bay (MICA 2009).

There are some other conservation initiatives in the bay with work conducted by the Bluenose Coastal Action Foundation (BCAF) and there are also areas closed to scallop dragging (Bennett 2004). Some research has occurred in the bay but there is a lack of information of the significance of the marine environment. There are a few current and planned research initiatives in the area including:

- BCAF is conducting the Gold River Restoration Plan (with the Atlantic salmon Federation) for the recovery of salmonid populations. They also have a Mahone Bay Roseate Tern Recovery Project (RTRP) (Environment Canada 2008a).
- Marine Environmental Prediction System (MEPS) is a $3.6 million infrastructure project funded by the Canada Foundation for Innovation (CFI) and others. The coastal embayment component has been established in Lunenburg Bay (Bundy *et al.* 2007).
- A recent award of $2.7M from the Canadian Foundation for Climate and Atmospheric Sciences (CFCAS) provides research funding and management support for the Lunenburg coastal observation and prediction project (Bundy *et al.* 2007)

Although there are several research initiatives underway in Mahone Bay, few are directed towards collecting information pertinent to coastal conservation planning in subtidal areas.

Summary

Table 4.10 below summarizes the key information provided in the site profile. Mahone Bay has several important ecological attributes, which align with two of the *Oceans Act* criteria for MPA establishment. There are high levels of human use in the area and more information is required to confirm the ecological importance of the area.

Table 4.10 Summary of Mahone Bay Site Profile

***Oceans Act* Criteria (s.35)**	**Ecological Attributes**	**Human Uses**	**Current Protection and Research Initiatives**
(a) The conservation and protection of commercial and non-commercial fishery resources, including marine mammals, and their habitats; (d) The conservation and protection of marine areas of high biodiversity or biological productivity	• Spawning area for pollock and Northern shrimp • Nursery area for juvenile pollock, sand lance, and hake • Former bluefin tuna feeding area • Seal aggregations • Scattered salt marshes and dense eelgrass beds • Dense and healthy marine plant beds; abundant Irish moss • SARA species: Roseate Tern • Birds: colonies, bay ducks, sea ducks	• High levels of residential and some industrial development • Fishing - mackerel (important) - scallops - lobster • Dredging • Several aquaculture operations • High levels of tourism and recreation • Rockweed harvesting (low levels)	• Several research initiatives underway for climate prediction; few research initiatives for marine conservation planning • Recovery planning initiatives • Several small terrestrial protected areas, that make up a small portion of the shoreline

4.6 St. Margaret's Bay

St. Margaret's Bay has been the focus of several research and monitoring initiatives and much is known about the ecological significance of the area. The importance of this area for critical life cycle stages for several species and for species at risk is recognized by numerous conservation organizations and government agencies. The area is particularly known for its importance for marine mammals and commercial species such as mackerel. Ecotourism and fisheries are the most significant human activities in the area.

Location and Population

St. Margaret's Bay is located approximately 30 km west of downtown Halifax. The study area comprises the entire bay and is 154 km^2. See figure 4.22 for a location map of St. Margaret's Bay. The border between Halifax Regional Municipality and Lunenburg County intersects the bay in the southwest region near Hubbards Provincial Park (Service Nova Scotia 2006). Tantallon is the only major town in the area with a high population density of 140-11,500 people per km^2. The rest of the bay has a population density of 20-140 people per km^2 (Municipal Services 2001). Tantallon is one of the areas along the bay that is experiencing population growth and rapid development (St. Margaret's Bay Stewardship Association 2008).

Physical and Oceanographic Attributes

St. Margaret's Bay is a large, semi-enclosed bay that has been classified as an intermediate pelagic bay (Greenlaw 2009) with a total area of approximately 154 km^2, a coastline of approximately 124 km, and a maximum depth of approximately 91 m, the second deepest of the twenty sites in this report. The seabed has relatively uniform bathymetry with variation near the headlands of the bay (DFO 2007d; Bennett 2004). The watershed drainage area is 819.1 km^2 and the bay is flushed by tidal currents and exhibits strong estuarine circulation (DFO 2007d; McCullough *et al.* 2005; Lane and Associates 1992). The area has a high flushing rate caused by coastal upwelling (Doherty and Horsman 2007; Platt and Irwin 1968). See Figure 4.21 for the bathymetry map.

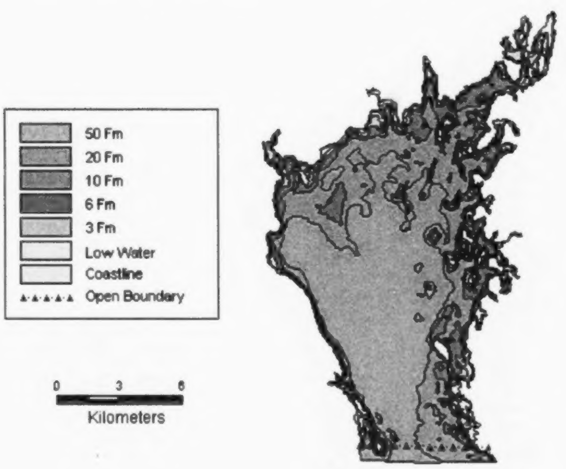
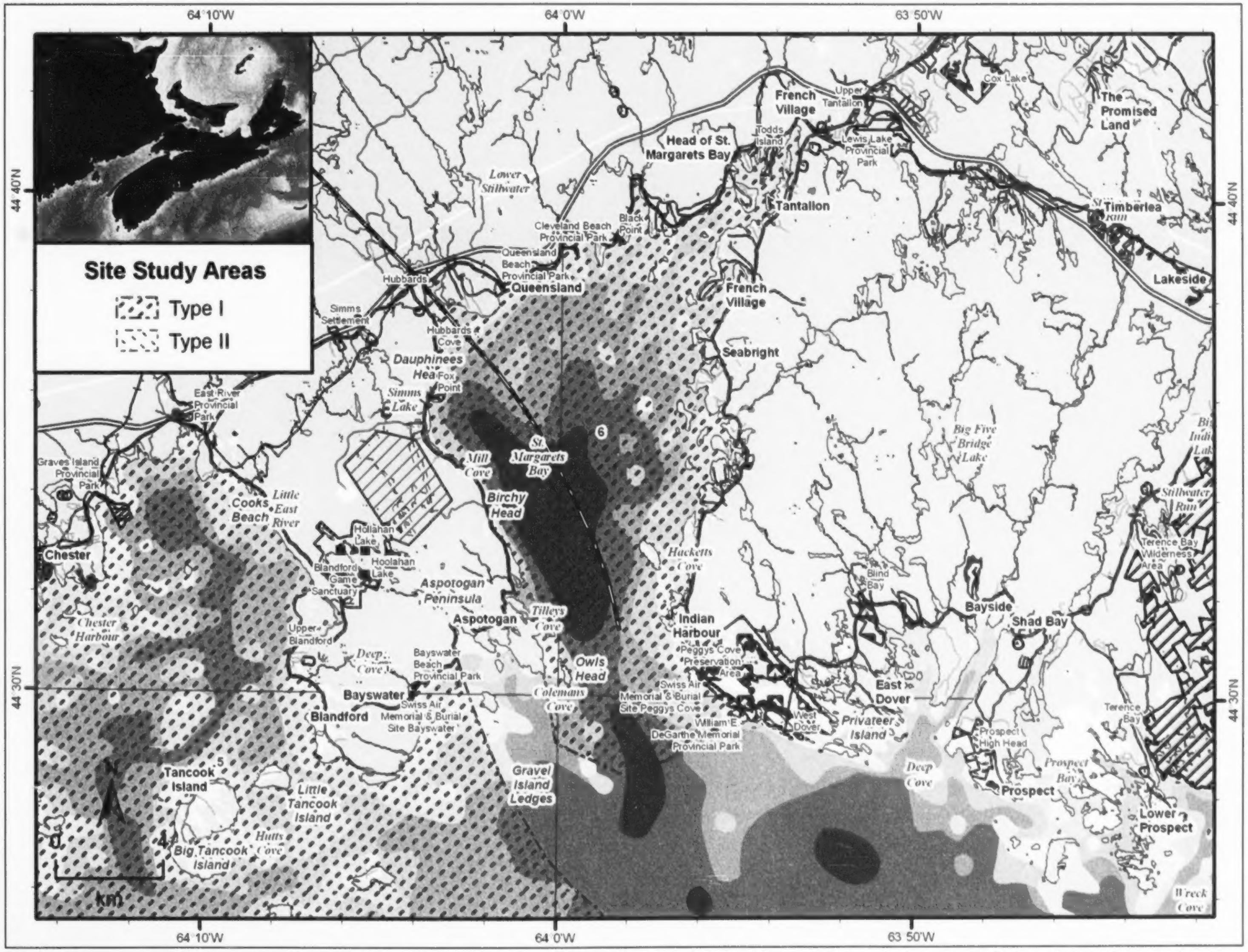


Figure 4.21 St. Margaret's Bay Bathymetry (DFO 2007d)
1 Fm = 1.83 m , Coastline = intertidal zone

The surrounding landscape is classified as granite barrens which comprise extensive coastal barrens with bogs (Davis and Brown 1996b). The bay is surrounded by rocky shoreline comprised primarily of boulder beaches, bedrock, pebble-cobble beaches, and white sand beaches (*Ibid.*). Some of these features are illustrated in Figure 4.23. The exposed conditions of the area provide suitable habitat for rare Arctic alpine flora (*Ibid.*). There are extensive marine flats at Queensland Beach and two estuarine flats totalling 138 ha (McCullough *et al.* 2005). The area exhibits low to moderate sensitivity to sea-level rise (NRCan 2007).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Cox Lake
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Head of St. Margarets Bay
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Black Point
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Queensland
Hubbards
French Village
Lakeside
Simms Settlement
Hubbards Cove
Seabright
Dauphinees Head
Fox Point
Simms Lake
East River Provincial Park
6
St. Margarets Bay
Big Five Bridge Lake
Graves Island Provincial Park
Mill Cove
Birchy Head
Little East River
Cooks Beach
Stillwater Run
Hollahan Lake
Chester
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Gravel Island Ledges
Deep Cove
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Little Tancook Island
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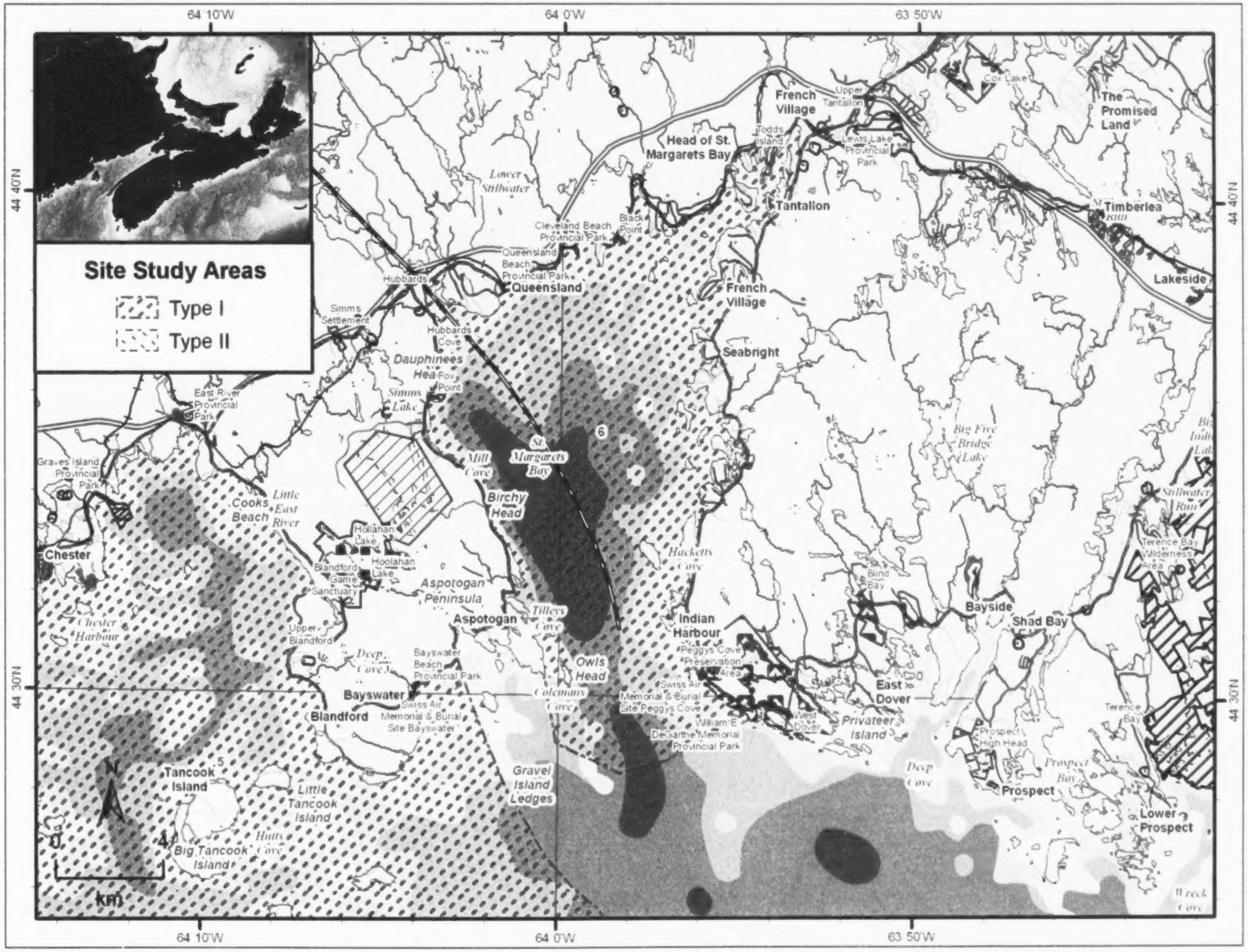
Hutts Cove
Big Tancook Island
Lower Prospect
Wreck Cove

Figure 4.22 Location Map for St. Margaret's Bay (Site #6). Basemap layers: land 1: 50 000, 1: 250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); Restricted and Limited Use Land Database Layers (NSDNR 2006b). Refer to Figure 4.1 for legend.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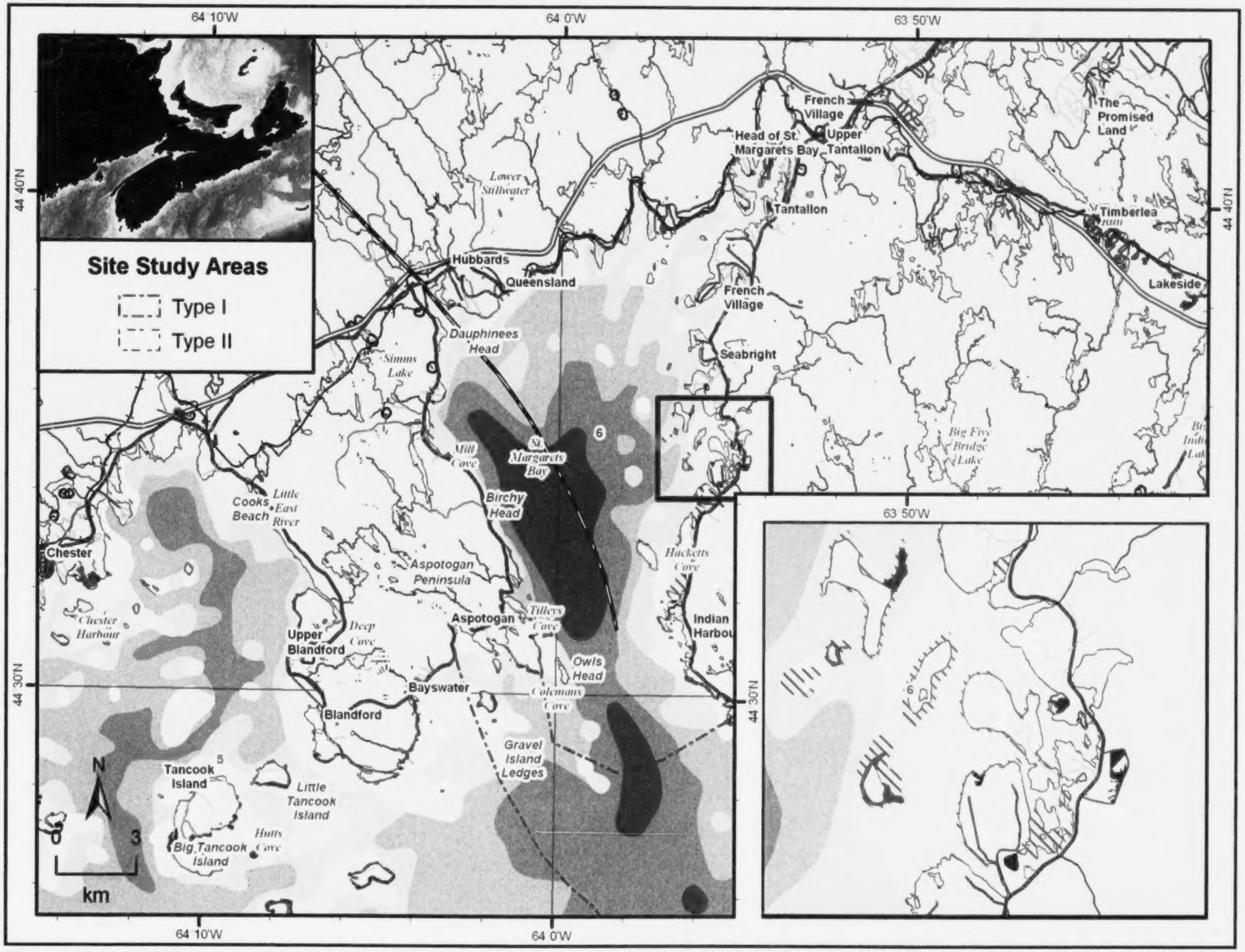
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Hacketts Cove
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Aspotogan
Tilleys Cove
Indian Harbou
Upper Blandford
Deep Cove
Owls Head
Bayswater
Colemans Cove
Blandford
Gravel Island Ledges
N
Tancook Island
5
Little Tancook Island
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Big Tancook Island
Hutts Cove
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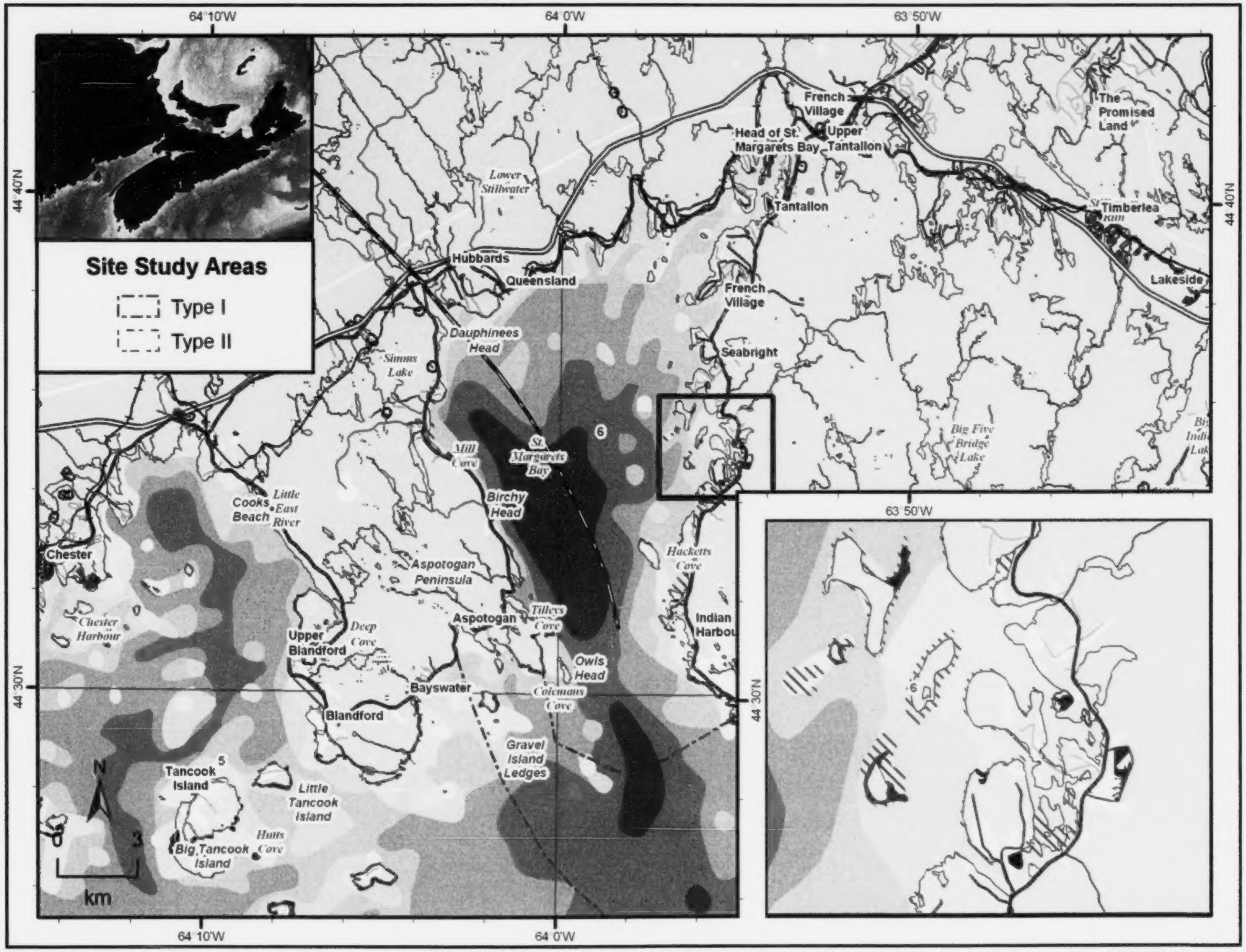
Figure 4.23 Coastal Habitats in St. Margaret's Bay (Site #6). Basemap layers: land 1:50 000, 1:250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); NSDNR Wetlands Database layers (NSDNR 2000). Refer to Figure 4.2 for legend.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Hacketts Cove
Aspotogan Peninsula
Chester Harbour
Upper Blandford
Deep Cove
Aspotogan
Tilleys Cove
Indian Harbou
Owls Head
Bayswater
Colemans Cove
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Gravel Island Ledges
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Big Tancook Island
Hutts Cove
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Figure 4.23 Coastal Habitats in St. Margaret's Bay (Site #6). Basemap layers: land 1:50 000, 1:250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); NSDNR Wetlands Database layers (NSDNR 2000). Refer to Figure 4.2 for legend.

Ecological Attributes

St. Margaret's Bay was identified by scientific experts as an EBSA as it meets two of the three primary EBSA criteria: uniqueness and aggregation (Doherty and Horsman 2007). The area was identified two times by scientific experts in the EBSA identification process compared to other sites which were identified up to five times for ecological significance (*Ibid.*). The bay was also identified in the SHACI report by McCullough *et al.* (2005) as one of eight significant habitats and has a detailed description of how it meets the SHACI criteria for significant habitat.

St. Margaret's Bay contains spawning areas for Atlantic cod, mackerel, herring, and yellowtail flounder (Benham and Trippel 2002; Doherty and Horsman 2007; McCullough *et al.* 2005; Bennett 2004). In the early 1990s lobster harvesters obtained twice the catch rate of berried females in Lunenburg and western Halifax counties as in Queens and eastern Shelburne counties (Miller 1997). The bay may therefore be a source for lobster larvae, although the area is not an important lobster fishing area in Nova Scotia relative to other areas.

The area provides habitat for several SARA-listed and COSEWIC-assessed species which have frequented the area including Atlantic cod, harbour porpoises, Roseate Terns, and leatherback turtles (Gowans pers. comm. 2001 *In* McCullough et al. 2005). Leatherback turtles are satellite-tagged in the area in summer months (James *et al.* 2005). Fin and humpback whales are rare but have been seen in the area (*Ibid.*). Other cetaceans including minke whales and white-beaked and white-sided dolphins frequent the area (McCullough *et al.* 2005; Bennett 2004).

Urchins are abundant (den Heyer 2007 in DFO 2007d) and one species of zooplankton, the copepod *Acartia spp.*, is especially abundant in the bay (Head and Harris 2007). Although generally found offshore, populations of Northern shrimp can be found in St. Margaret's Bay where they may be spawning (Koeller 2000; Koeller *et al.* 2007 *In* Bundy *et al.* 2007). Chedabucto, Mahone, and St. Margaret's Bay are known inshore areas for populations of Northern shrimp (Koeller 2000; Koeller *et al.* 2007 *In* Bundy *et al.* 2007).

Of ten sites in a transect survey along the Atlantic coast of Nova Scotia, St. Margaret's Bay had the highest species diversity using transect lobster traps (Bundy 2007) and the area is known to have a diverse sub-littoral community (Doherty and Horsman 2007). There are nursery grounds for pollock, silver hake, and Cunner and small patches of eelgrass and salt marsh that are known to support juvenile fish (Miller 2006 *In* DFO 2006a; Trippel 2002 *In* McCullough *et al.* 2005).

The area is highly productive with localized upwelling and productive phytoplankton areas (Davis and Brown 1996b; Platt and Irwin 1968; Doherty and Horsman 2007) and a higher than average biomass of rockweed and kelp beds (*Laminaria longicruris*) (McCullough *et al.* 2005).

St. Margaret's Bay has a low to medium level of naturalness; the bay experiences frequent shellfish harvesting closures (McCullough *et al.* 2005 and Environment Canada 2003), likely as a result of high levels of coastal development surrounding the bay. There are also numerous invasive species in St. Margaret's Bay. These include dense stands of *Codium fragile*, the colonial bryozoan *Membranipora membranacea*, *Convoluta convoluta* (flatworm) off Blandford, *Ciona intestinalis* (tunicate) in the eastern portion of St. Margaret's Bay, and high numbers of green crab (Bundy *et al.* 2007).

Bird Information

This area does not coincide or otherwise overlap with presently identified IBAs. Colonies representing approximately seven species are located within the identified area. Wedge Island has hosted important if not significant numbers of Roseate Tern (endangered, SARA; CWS) and could be revisited as a potential IBA. The area is not known to support high numbers of geese but can support high numbers of dabbling ducks. Low numbers of bay ducks have also been recorded here. However, the deeper outer bay waters are known to host high to very high numbers of sea ducks (CWS).

Important Marine Ecological Features:

- Spawning area for Atlantic cod, mackerel, herring, and yellowtail flounder
- Nursery area for pollock, silver hake, and cunner
- Populations of Northern shrimp found in the area
- High species diversity
- High productivity with localized upwelling and abundance of phytoplankton
- SARA-listed species: Roseate Tern (endangered) and leatherback turtle (endangered)
- COSEWIC-assessed species: Atlantic cod (endangered) and harbour porpoise (special concern)
- Higher than average biomass of rockweed and kelp
- Birds: species at risk, sea ducks, colonies

Humans Uses

The human uses in St. Margaret's Bay include coastal development, fishing, marine plant harvesting, aquaculture, recreation, and tourism.

Coastal Development

St. Margaret's Bay experiences high coastal development due to high residential and commercial growth within Tantallon and surrounding areas. There are several species of potentially harmful phytoplankton (McCullough *et al.* 2005), past occurrences of anoxia and growing shellfish closures (McCullough *et al.* 2005 and Environment Canada 2003), which are likely impacts of coastal development.

The surrounding Municipality of the District of Chester and Halifax Regional Municipality both have comprehensive municipal planning strategies and associated land use bylaws (see Appendix D) (CBCL Limited 2009). Halifax Regional Municipality has the only municipal planning strategy and associated bylaws that specifically address coastal management issues through development setbacks for properties along the coast and other watercourses, among other measures (HRM 2006).

Commercial Fishing

Low amounts of fishing occur in the area for groundfish, herring, and lobster (DFO 2005a, VDC 2009). The bay is an important mackerel trap net area in Nova Scotia (DFO 2005a) with high landings of mackerel caught from 2007-2009 (VDC 2009). Herring is also caught by trap net but in low quantities (DFO 2009f; VDC 2009). There are four Small Craft Harbours in St. Margaret's Bay and two recreational public or private wharves. There is also one fish processing plant in the area (CCN 2006).

Lobster landings are relatively low in St. Margaret's Bay compared to other areas in this report. In grid square 318, the reporting unit that most closely aligns with the study area, 2008 lobster landings are estimated at 90 MT. These landings comprise 0.30% of 2008 landings in DFO's Maritimes Region and 2.90% of LFA 33 landings in 2008. LFA 33 comprises 10% of 2008 landings in the Maritimes Region (VDC 2009).

The bluefin tuna trap net fishery is significant in this area with high landings from 2007-2010 (L. Hussey-Bondt, DFO Fisheries and Aquaculture Management Branch, pers. comm. 2010). Bluefin tuna ranching once occurred in St. Margaret's Bay.

There was an experimental shrimp fishery in the bay which has been discontinued. There were low landings of snow crab in the bay from 1999-2003 (DFO 2005a) which remain low at the mouth of the bay making up 1% of total landings in the bay (VDC 2009). Mobile gear has been banned from the bay (DFO 2003b; European Cetacean Bycatch Campaign 2003).

There is little potential for commercial development of ocean quahog but the population has occasionally been fished during temporary closures of other beds (McCullough *et al.* 2005). There is also blood and sand worm harvesting at Boutilier's Cove, Hubbards Cove, Cleveland Beach and Indian Harbour (McCullough *et al.* 2005; Bundy *et al.* 2007); the intensity is undetermined.

Table 4.11 below summarizes commercial fisheries in St. Margaret's Bay.

Table 4.11 Summary of Major Commercial Fisheries and Gear Used in and Adjacent to St. Margaret's Bay

Species	Landings*	Gear	Year	Source
Groundfish	L-M	Bottom longline	1999-2003 2007-2009	DFO 2005a VDC 2009
Herring	L	Mid-water gillnet	1999-2003 2007-2009	DFO 2005a VDC 2009
Mackerel	H	Trap net	1999-2003 2007-2009	DFO 2005a VDC 2009
Lobster	L	Trap	2008	VDC 2009
Bluefin Tuna	H	Trap net	2007-2009	L. Hussey-Bondt, pers. comm. 2010.

*H = high, M = medium, L = low

Marine Plant Harvesting

The entire inshore portion of the bay is divided into sectors for rockweed harvesting management (Sharp *et al.* 2007 *In* DFO 2007c). There is one rockweed lease in the bay which covers the entire eastern portion of the bay (Justin Huston, Nova Scotia Fisheries and Aquaculture, per. comm. 2009), however landings are minor compared to other areas in Nova Scotia such as Lobster Bay. The average area covered by rockweed in St. Margaret's Bay is 82.93 ha with a total standing crop of 4984.25 tonnes, and a total annual harvestable crop of 498.43 tonnes (Sharp and Veinot 2006). Irish moss is present at Paddy's Head and Indian Harbour with an average weight of 0.5 and 0.9 kg per m^2 and 99% and 100% purity (Sharp *et al.* 2007 *In* DFO 2007c). Rockweed and Irish moss harvesting occurs sporadically and on a small-scale within the bay. The harvested biomass does not compare in magnitude to that in other areas of Nova Scotia, particularly the South Shore (DFO 1998).

Aquaculture

There are four licenses for shellfish in the bay (see Figure 4.24, Service Nova Scotia 2008). It appears that none of the licenses are presently active (all license holders are under review) however, there was environmental monitoring in the area in 2004, indicating that there were active licenses at that time (NSDFA 2006). The four licenses make up a small portion of the bay, 0.7 km^2 or 0.04%.

Salmon aquaculture occurred in St. Margaret's Bay in the past (Bennett 2004). There is a salmon site near Gravel Island in Aspotagan Harbour (Service Nova Scotia 2008).

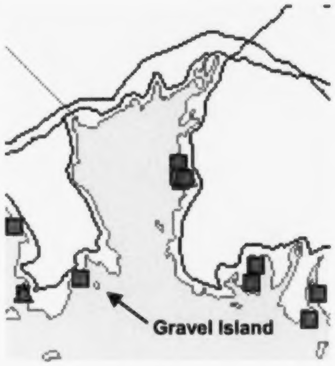


Figure 4.24 Aquaculture Licenses/Leases in St. Margaret's Bay (denoted by green squares) (Service Nova Scotia 2008)

Tourism, Recreation, and Culture

Ecotourism is one of the mainstays of the area and tourists come to enjoy the recreational opportunities, sightseeing, and particularly whale and bird watching. Bayswater Beach, Hubbards Beach, and Cleveland Beach are designated Provincial Parks. Queensland and Black Point Beach are also popular tourist destinations. There is considerable tourism infrastructure including public wharves at Peggy's Cove, Northwest Cove, Shining Waters, Fox Point, and Mill Cove; a yacht club in Hubbards; several sea kayak rental companies; fishing charters from Peggy's Cove (Peggy's Cove Fishing Charters), dive charters; and Peggy's Cove Whale and Puffin Tours (Bennett 2004). There are also cultural features including two Swissair Memorial and Burial sites and the William E. DeGarth Memorial Provincial Park.

Current Protection and Research/Conservation Initiatives

There are likely more research and conservation initiatives occurring in St. Margaret's Bay than in any of the other sites identified in this report. The St. Margaret's Bay Stewardship Association, the Five Bridge Wilderness Heritage Trust (FBWHT), and the Woodens River Watershed Environmental Organization (WRWEO) are the lead environmental organizations and also the largest in the area. These organizations are primarily focused on addressing impacts to the marine and coastal environment through terrestrial conservation and promoting good land-use practices (A. Baccardax, pers. comm. 2008).

The St. Margaret's Bay Stewardship Association is actively promoting integrated coastal zone management for the bay to improve collaboration for more effective land-use planning and is actively involved in discussions with municipal, provincial, and federal government departments to address the issues (St. Margaret's Bay Stewardship Association 2008). The WRWEO is advocating for a Wilderness Area on the large expanse of Crown Lands on the east side of the bay, some of which touches the coast. CPAWS-NS has been advocating for the protection of St. Margaret's and Mahone Bay, particularly for the designation of a Parks Canada National Marine Conservation Area (NMCA) (CPAWS-NS 2008).

Other conservation organizations include St. Margaret's Bay Area Rails to Trail Association, the Route Enhancement Committee for the Aspotogan Peninsula (RECAP), and the Chebucto Wilderness Coalition (St. Margaret's Bay Stewardship Association 2008).

There is terrestrial protection adjacent to St. Margaret's Bay, although it is limited to 3 small provincial parks (Cleveland Beach Provincial Park, Queensland Beach Provincial Park, and Bayswater Beach Provincial Park) and the Peggy's Cove Preservation Area (NSDNR 2006b).

The bay is well researched and has been the subject of numerous studies including long-term phytoplankton monitoring (1989-1994) (Keizer *et al.* 1996), studies of primary productivity, studies on habitat including habitats associated with cod survival (Tupper and Boutilier 1995) and marine plant studies (Sharp *et al.* 2007). It is also the only station of 10 in the CTD study for the IEP sampled more than once and "shows a strong seasonal signal" (Horne 2007).

Research was recently completed in the area and more ecological information will be available upon publication of results from the Fishery-Independent Survey completed in 2006 as part of the DFO-FSRS IEP (see boxed feature on page 18). This survey involved transect sampling of nine sites in Nova Scotia, one of which was St. Margaret's Bay (DFO 2006a). Further, the results of the analysis of LEK surveys of commercial fish harvesters which was also completed as part of the IEP in 2006, will contribute to the understanding of the ecological significance of the area. The work is expected to be published in 2009 and will address some of the data gaps (A. Bundy, DFO Science Branch, pers. comm. 2009).

Summary

Table 4.12 below summarizes the key information provided in the site profile. St. Margaret's Bay has several important ecological attributes and meets three of the *Oceans Act* criteria for MPA establishment. There are several research and conservation initiatives occurring in the area. The area is experiencing rapid residential and commercial development.

Table 4.12 Summary of St. Margaret's Bay Site Profile

***Oceans Act* Criteria (s.35)**	**Ecological Attributes**	**Human Uses**	**Current Protection and Research Initiatives**
(a) The conservation and protection of commercial and non-commercial fishery resources, including marine mammals, and their habitats; (b) The conservation and protection of endangered or threatened marine species, and their habitats (d) The conservation and protection of marine areas of high biodiversity or biological productivity	• Spawning area for Atlantic cod, mackerel, herring, and yellowtail flounder • Nursery area for pollock, cunner, and silver hake • Population of Northern shrimp • High species diversity • High productivity: localized upwelling and abundance of phytoplankton • SARA species: leatherback turtle and Roseate Tern • COSEWIC species: Atlantic cod and harbour porpoise • Higher than average biomass of rockweed and kelp • Birds: sea ducks, colonies	• High levels of residential and commercial development • Fishing - mackerel (important) - herring - lobster - groundfish - bluefin tuna • Low levels of Irish moss and rockweed harvesting • Aquaculture: shellfish • High levels of tourism and recreation	• Several community organizations with conservation initiatives • Minimal terrestrial protection compared to other sites • Current research: IEP (LEK mapping and fishery-independent surveys) • Oceanographic and phytoplankton/ productivity research is ongoing

4.7 Eastern Shore Islands Wildlife Management Area

The Eastern Shore Islands Wildlife Management Area (WMA) is a very large marine area that encompasses over 60 publicly-owned islands and is designated under the Nova Scotia *Wildlife Act*. The area is also an IBA and protects several breeding bird colonies including the endangered Harlequin Duck and Roseate Tern. The area may be important for commercial and non-commercial fish species including Atlantic cod, lobster, and scallops, and could act as a nursery area for a diversity of juvenile fish. There are few users of the marine area, which may have a pragmatic advantage for additional conservation measures.

Location and Population

The Eastern Shore Islands WMA is located along Marine Drive on the Eastern Shore of Nova Scotia. The area extends from just outside Sheet Harbour Passage to Ecum Secum within Halifax County with its easternmost border slightly overlapping into Guysborough County. The study area comprises the entire Eastern Shore Islands WMA and is 121.7 km^2. It contains numerous islands and is located off the coast coming closest to land at Long Point outside of West Quoddy. For a location map see Figure 4.25. There are several small communities along the adjacent mainland, the largest of which is Sheet Harbour with a population of approximately 828 (Destination Nova Scotia 2009). The Eastern Shore has some of the lowest populations in Nova Scotia. The population density of the study area is very low with an average of 0-10 people per km^2 (Municipal Services 2001).

Physical and Oceanographic Attributes

The Eastern Shore Islands WMA is an archipelago of elongated islands; most are Crown Land and have very minimal development. The total area is 12,535 ha (125.35 km^2), 11,610 ha of which is marine (NSDNR 2009a) and the area has a maximum depth of 91 m (CHS Charts 4013, 4227, 4234, and 4235). Coastal wetlands and marine flats comprise 536 hectares and the islands themselves have a total area of 389 ha. The island environments consist of coastal forests, several cliffs, rocky beaches, coastal barrens, and small freshwater wetlands (NSDNR 2009a). Some of these features are shown in Figure 4.26; there are few sensitive coastal features in this area. There are approximately 60 publicly-owned islands within the WMA and a few privately owned islands with minimal development (S. Boates, NSDNR, pers. comm. 2008 *In* Gromack 2008). The only Crown Land development is a lighthouse on Beaver Island (NSDNR 2009a). There is also a proposal to expand the WMA to other areas along the Eastern Shore to contain additional provincially-owned islands. The addition would result in the protection of 40 more islands with a total area of 151 ha for the protection of breeding colonial seabirds (NSDNR 2009a).

The Eastern Shore is characterised by its submerged rocky shoreline with several indents which are drowned river estuaries. The offshore islands are primarily made up of greywacke bedrock. There are a variety of habitats, from rocky shores to extensive kelp. Salt marshes are limited due to minimal sediment accumulation. Many of the islands were formed by the erosion and submersion of headlands during recent coastal submergence. Unlike other areas along the Eastern Shore, drumlin formations in this area are rare. There is low surface water coverage and salt marshes are small and scattered (Davis and Browne 1996b). The area is very exposed, with limited shelter provided by the islands allowing for the survival of northerly species. Warmer slope waters in the summer sometimes bring in marine species from the south (*Ibid.*). The area does not have an abundance of sensitive coastal features and is considered moderately sensitive to sea level rise (NRCan 2007).

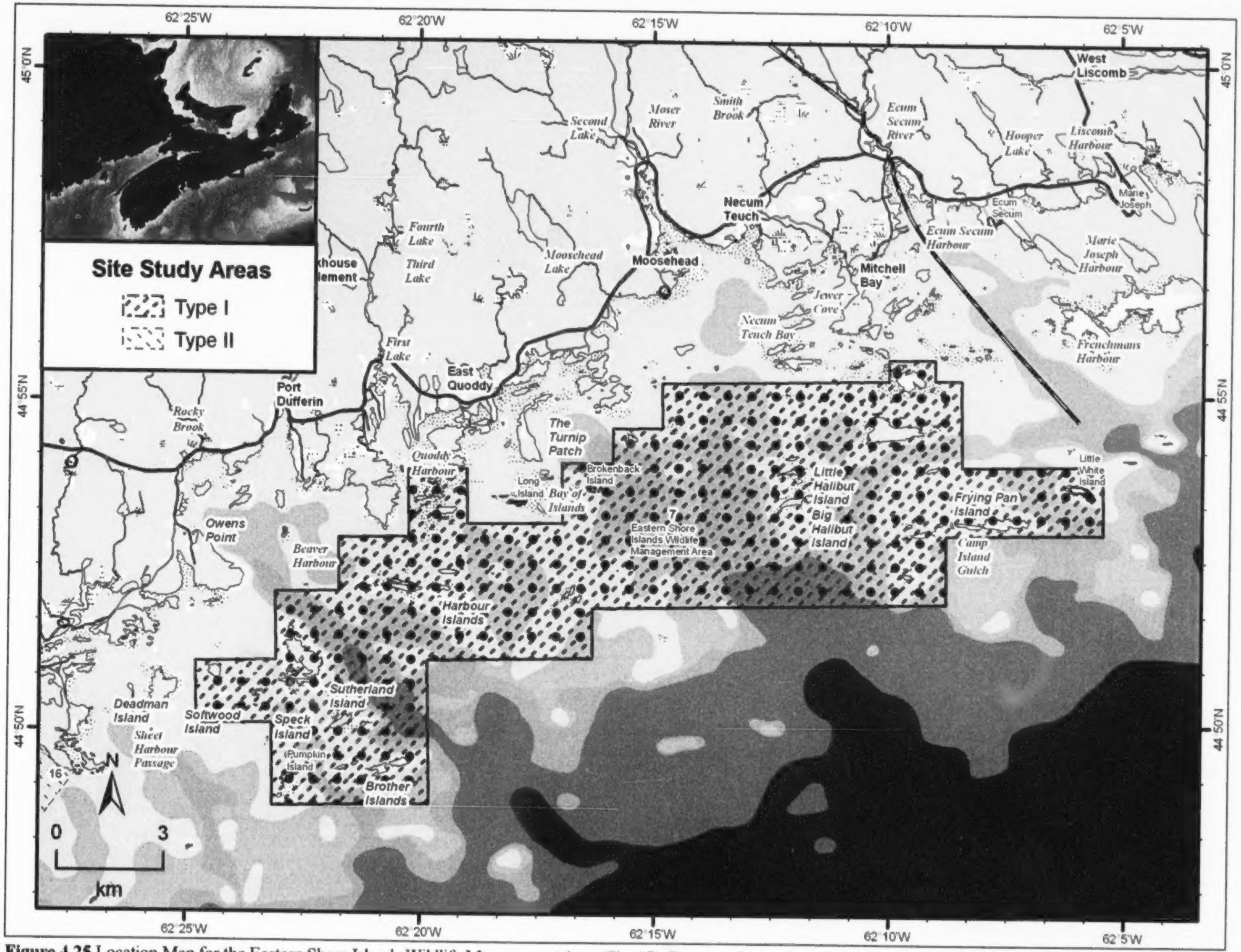
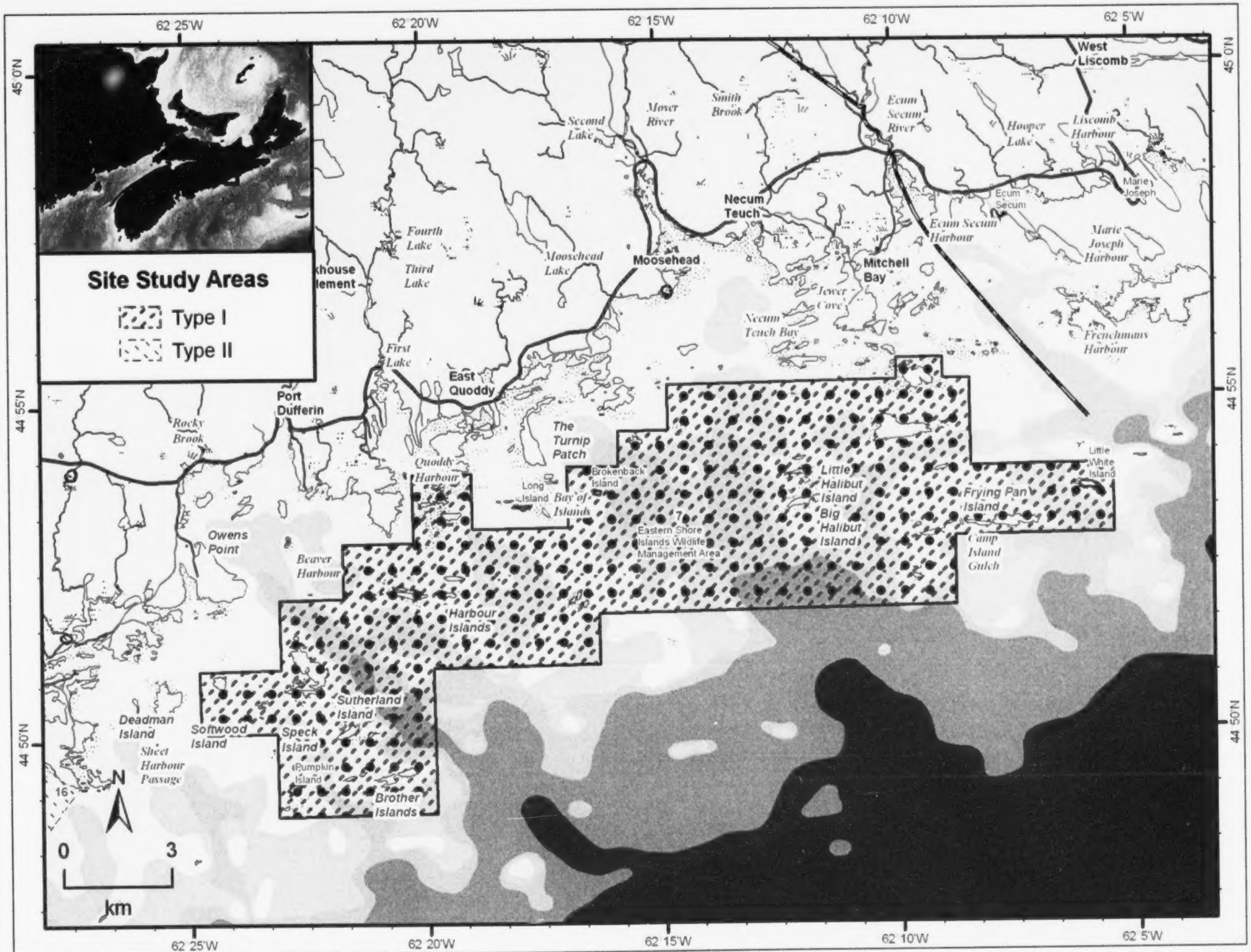

62°25'W
62°20'W
62°15'W
62°10'W
62°5'W
45°0'N
44°55'N
44°50'N
Site Study Areas
Type I
Type II
West Liscomb
Moser River
Smith Brook
Second Lake
Ecum Secum River
Hooper Lake
Liscomb Harbour
Marie Joseph
Necum Teuch
Ecum Secum
Ecum Secum Harbour
Fourth Lake
Third Lake
Moosehead Lake
Moosehead
Mitchell Bay
Marie Joseph Harbour
Jewer Cove
Necum Teuch Bay
Frenchmans Harbour
First Lake
East Quoddy
Port Dufferin
Rocky Brook
The Turnip Patch
Quoddy Harbour
Brokenback Island
Long Island
Bay of Islands
Little Halibut Island
Big Halibut Island
Frying Pan Island
Little White Island
7
Eastern Shore Islands Wildlife Management Area
Camp Island Gulch
Owens Point
Beaver Harbour
Harbour Islands
Sutherland Island
Deadman Island
Softwood Island
Speck Island
Sheet Harbour Passage
Pumpkin Island
Brother Islands
16
N
0
3
km

Figure 4.25 Location Map for the Eastern Shore Islands Wildlife Management Area (Site #7). Basemap layers: land 1: 50 000, 1: 250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); Restricted and Limited Use Land Database Layers (NSDNR 2006b). Refer to Figure 4.1 for legend.


Site Study Areas
Type I
Type II
62 25'W
62 20'W
62 15'W
62 10'W
62 5'W
45 0'N
44 55'N
44 50'N
West Liscomb
Second Lake
Moser River
Smith Brook
Ecum Secum River
Hooper Lake
Liscomb Harbour
Marie Joseph
Ecum Secum
Necum Teuch
Ecum Secum Harbour
Marie Joseph Harbour
Fourth Lake
Third Lake
Moosehead Lake
Moosehead
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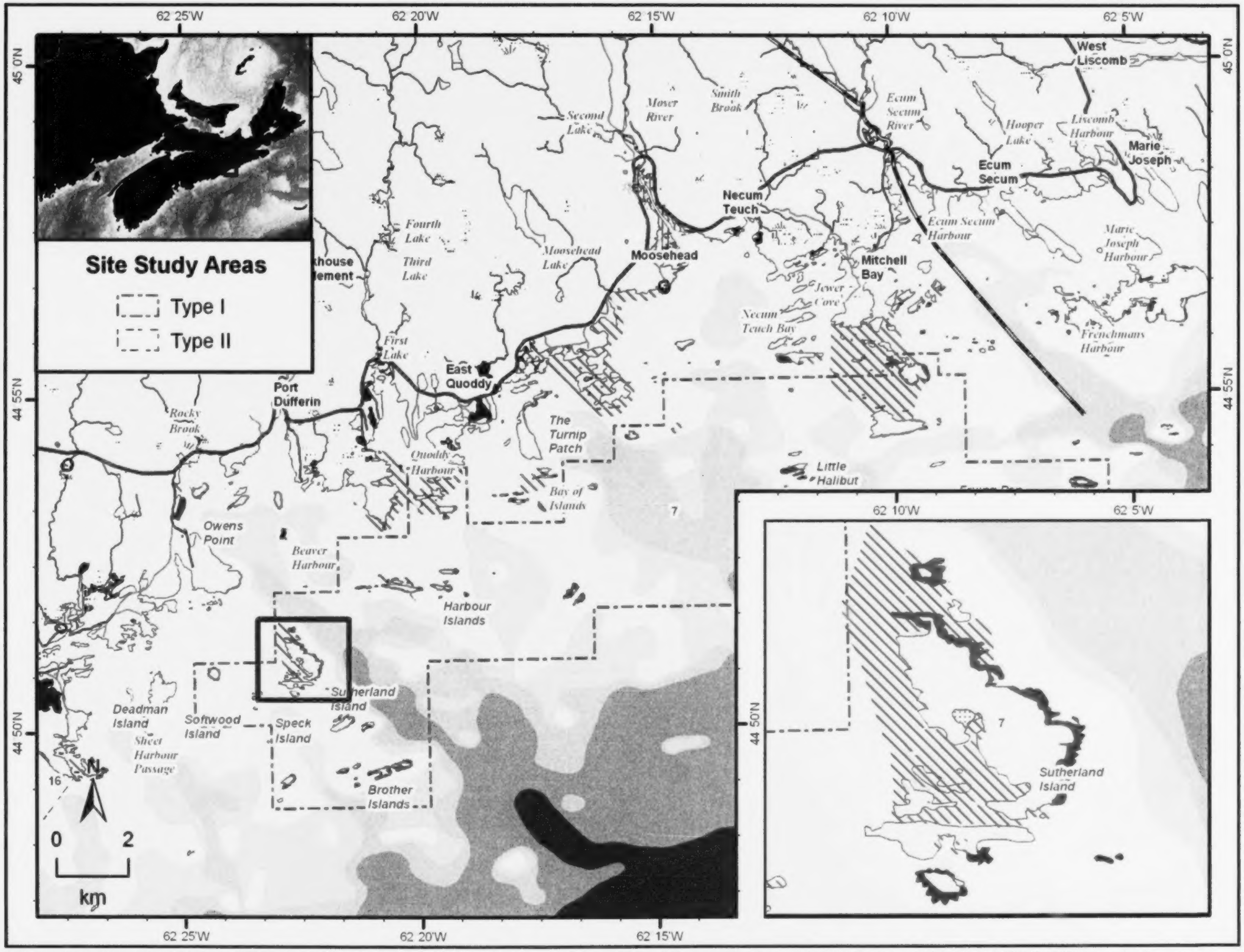
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62 20'W
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Bay of Islands
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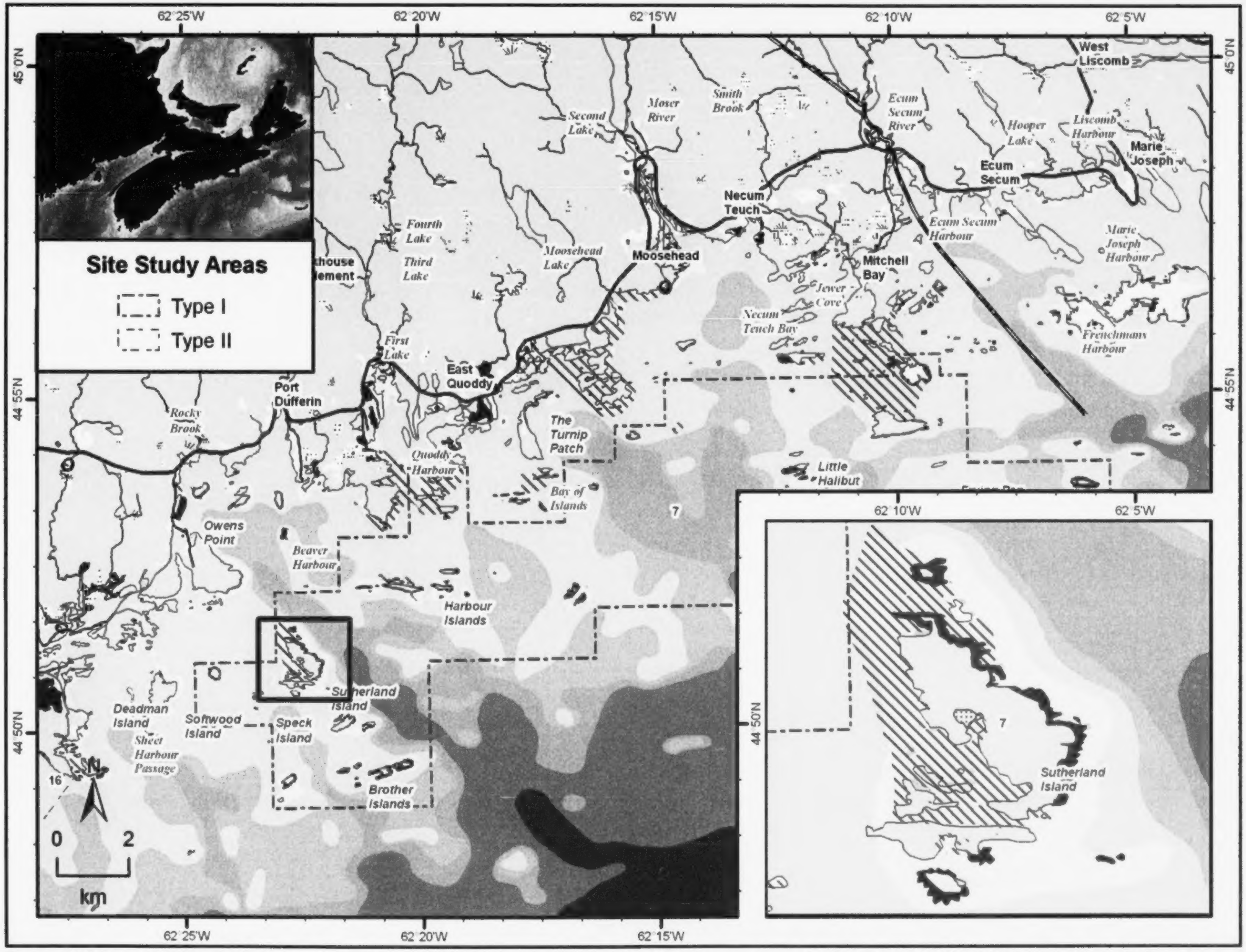
7
Owens Point
Beaver Harbour
Harbour Islands
Deadman Island
Softwood Island
Speck Island
Sutherland Island
Sheet Harbour Passage
Brother Islands
16
N
0
2
km
Sutherland Island

Figure 4.26 Coastal Habitats in the Eastern Shore Islands Wildlife Management Area (Site #7). Basemap layers: land 1:50 000, 1:250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); NSDNR Wetlands Database layers (NSDNR 2000). Refer to Figure 4.2 for legend.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Speck Island
Sheet Harbour Passage
Brother Islands
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Sutherland Island

Figure 4.26 Coastal Habitats in the Eastern Shore Islands Wildlife Management Area (Site #7). Basemap layers: land 1:50 000, 1:250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); NSDNR Wetlands Database layers (NSDNR 2000). Refer to Figure 4.2 for legend.

Ecological Attributes

The Eastern Shore Islands WMA was identified by scientific experts as an EBSA. The WMA meets three of the EBSA criteria, aggregations, fitness consequences, and naturalness. It was identified two times by scientific experts in the EBSA identification process (Doherty and Horsman 2007). The Eastern Shore Islands were originally classified as a Type III site but were later classified as a Type I site due to the support for the provincial government in increased protection of the area as determined at the first meeting of CPANS (see Section 3.0).

Although little is known about the marine environment, there is some evidence that the area is biologically important. The WMA has a high diversity and abundance of marine algae, indicating high productivity (Moore *et al.* 1986). There are fewer salt marshes and eelgrass beds than in other areas. This could be due to a lack of information on eelgrass beds or a result of unsuitable habitat.

Atlantic cod, a species recently assessed as endangered by COSEWIC (2010), spawn in the area and it is also a former haddock spawning area (Bundy *et al.* 2007). Surrounding areas demonstrate a very high larval species richness (King 2004) which may also be reflected in the WMA. There is a hake juvenile area in the WMA (Bundy et al. 2007) and there were 12 juvenile species identified at Moosehead Bay by O'Connor (2008), which provides additional evidence that the area may be a nursery area for marine species. The most abundant species found by O'Connor were three-spined stickleback and Atlantic herring.

The area also contains lobster bottom and scallop beds and there are aggregations of rock crab and potentially snow crab (McCullough *et al.* 2005). There are several seal haul-outs in the area which host one of the three largest grey seal breeding areas along the Atlantic coast of Nova Scotia identified in an aerial survey in 2007 (Lidgard 2007 *In* DFO 2007c). King (2004) noted that the surrounding area is important for pelagic special elements (east of the WMA), and the area was determined to have a high benthic and pelagic conservation value (King 2004).

Dive transects were conducted by CPAWS-NS in July and August 2009 in Port Joli and the Eastern Shore Islands WMA. Data were recorded along 16 transects of 50 m in length. Preliminary results demonstrate that the areas studied had 33.9% mean kelp cover and 0.01% eel grass cover. Common invertebrates included scallops, blue mussels, horse mussels, sea stars, limpets, chiton, whelks, hermit crab, rock crab, a few sponges, and very few lobster. Transects along boulder substrates had a high abundance of 25.5 fish per transect. Accurate quantities of lobsters and other invertebrates may be difficult to determine due to high densities of kelp which may provide cover. A full assessment of the findings will be made available in 2010 (CPAWS-NS, unpublished data, 2009).

The WMA meets the EBSA criteria for naturalness (Doherty and Horsman 2007) and there is likely a high degree of naturalness as there are few human uses in the area and there coastal development is minimal. However, there is an active gold mine at Port Dufferin (NSDNR 2006a) which may be impacting the area.

Bird Information

The Eastern Shore Islands are known primarily for their importance for colonial breeding and overwintering birds (McCullough *et al.* 2005; Doherty and Horsman 2007). This area encompasses much of the eastern half of the Eastern Shore Islands IBA (Number NS027), best known for hosting globally significant numbers of Common Eider and nationally significant numbers of other waterfowl species, including Black, Surf, and White-winged Scoters, during spring and fall migration. In addition, continentally significant numbers of Common Eider breed on islands in the area. Continentally significant numbers of Harlequin Duck (special concern, SARA; CWS), use the area during winter. Nationally significant numbers of Roseate Tern (endangered, SARA; CWS) have nested in colonies in the area (BLI 2009). Eleven other colonial species nest in this area during the summer months. Although dabbling duck numbers can be high in certain areas, the area around Halibut Island in particular can host high numbers of geese, namely Canada Goose (CWS). Inshore waters within the area can host bay duck numbers in the intermediate (2nd and 3rd quartile) range. The area hosts very high numbers of sea ducks.

Important Marine Ecological Features:

- Atlantic cod spawning area and historic haddock spawning area
- Nursery area for hake, herring, and other species
- Aggregations of invertebrates: lobster, scallop, snow crab, rock crab
- Numerous seal haul-outs
- SARA-listed species: Harlequin Duck (special concern) and Roseate Tern (endangered)
- COSEWIC-assessed species: Atlantic cod (endangered)
- Diverse and extensive marine algae
- Birds: IBA(1), species at risk, colonies, sea ducks

Human Uses

The Eastern Shore Islands WMA is provincially-protected and is therefore protected from land-based development on the islands and therefore many other human uses. Minimal fishing, aquaculture, and limited recreational activities are the only current human uses in the study area.

Coastal Development

Coastal development on the mainland is also very low, however, there are 10 mineral licenses between Quoddy Harbour and Ecum Secum (Fisher and Wenning 2008). There was once a gold mine at Port Dufferin (NSE 2009c) and there may be tailings in the area.

Commercial Fishing

Lobster and groundfish including Atlantic halibut are the only fisheries in the Eastern Shore Islands WMA and both have low landings (VDC 2009). Data for 2007-2009 do not show any fisheries within the study area, although scallop, groundfish, and Atlantic halibut landings are very near the area (VDC 2009). Groundfish landings were within the study area from 1999-2003 (DFO 2005a) and the fishery may therefore move in and out of the area from year to year. Atlantic halibut were caught very close to the study area in 1999-2003 and 2007-2009 (DFO 2005a; VDC 2009).

There were once significant porbeagle and blueshark landings to the west and east of the WMA (McCullough *et al.* 2005) but there is no current fishery for sharks. It was also stated by McCullough *et* *al.* (2005) that fair quantities of periwinkles can be found in the outer islands of the eastern shore, but it is uncertain if this applies to the WMA specifically.

The lobster fishery in this area is of low importance at the provincial scale. In grid squares 329 and 330, the reporting units that most closely align with the study area, 2008 lobster landings are estimated at 284 MT. These landings comprise 0.95% of 2008 landings in DFO's Maritimes Region and 40.02% of LFA 32 landings in 2008. LFA 32 comprises 2.38% of 2008 landings in the Maritimes Region (VDC 2009). Landings in these grid squares may be significant in LFA 32.

There is one Small Craft Harbour in the area, one private or government wharf, and two community wharves used for fishing (CCN 2006).

Table 4.13 below summarizes commercial fisheries in the Eastern Shore Islands WMA.

Table 4.13 Summary of Major Commercial Fisheries and Gear Used in and Adjacent to the Eastern Shore Islands WMA

Species	**Landings***	**Gear**	**Year**	**Source**
Groundfish and halibut	L	Bottom longline	1999-2003	DFO 2005a
Lobster	L	Trap	2008	VDC 2009

*H = high, M = medium, L = low

Aquaculture

There are no aquaculture licenses within the WMA, however there is an adjacent site in Quoddy Harbour where rainbow trout is farmed. The lease area is 3.86 ha (0.039 km^2) in size (see Figure 4.27, Service Nova Scotia 2008). This license may not be in operation as it has not been sampled under the EMP (NSDFA 2006). At present aquaculture is not perceived as a major threat to this area.

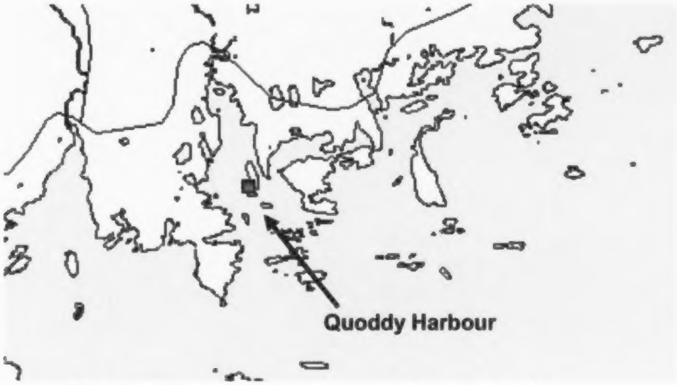


Figure 4.27 Aquaculture Licenses/Leases near the Eastern Shore Islands WMA (denoted by green squares) (Service Nova Scotia 2008)

Tourism, Recreation, and Culture

Kayaking, recreational diving, and recreational fishing are some of recreational opportunities within the calmer waters of the Eastern Shore Islands WMA. There are 3 kayak routes through the islands: one around Sutherland Island, one south of Snow Island encompassing High Island, and one near Ecum Secum around Little Goose Island (Highway7.com 2008). The closest park is Marie Joseph Provincial Park and the closest harbours are in Marie Joseph, Ecum Secum, and Ecum Secum West. Tourism facilities are very limited and there are no hotels or campgrounds in the area.

Current Protection and Research/Conservation Initiatives

Although the area is currently protected under Nova Scotia's *Wildlife Act* as a WMA, there is little protection for the marine portion of the WMA. There is interest from NSDNR for additional protection of the marine portion of the area.

Lane and Associates (1992) identified this area, among 16 others, as a potential site of significance during an initial scoping exercise, but later dropped the area prior to making its recommendations to Parks Canada. Parks Canada is not currently pursuing an NMCA designation in the Scotian Shelf marine region.

Research in the area is limited to sporadic bird surveys with very little current knowledge of the marine environment. CPAWS-NS conducted dive transects within the Eastern Shore Islands WMA in July and August 2009 to fill information gaps of current species and habitat distribution, as mentioned in the Ecological Attributes.

Summary

Table 4.14 below summarizes the key information provided in the site profile. Little current information of the marine environment of the Eastern Shore Islands Wildlife Management Area is available, however there are indications of ecological importance of the area for commercial and non-commercial species. The area meets three of the *Oceans Act* criteria for MPA establishment. There are very few human uses in the area and development is minimal.

Table 4.14 Summary of the Eastern Shore Islands WMA Site Profile

***Oceans Act* Criteria (s.35)**	**Ecological Attributes**	**Human Uses**	**Current Protection and Research Initiatives**
(a) The conservation and protection of commercial and non-commercial fishery resources, including marine mammals, and their habitats; (b) The conservation and protection of endangered or threatened marine species, and their habitats (d) The conservation and protection of marine areas of high biodiversity or biological productivity	• Spawning area for Atlantic cod; historic haddock spawning area • Nursery area for hake, herring, and other species • Aggregations of invertebrates: lobster, scallop, snow and rock crab • Numerous seal haul-outs • SARA species: Harlequin Duck and Roseate Tern • COSEWIC species: Atlantic cod • Diverse and extensive marine algae • Birds: IBA (1), colonies, sea ducks	• Low level of coastal development, however, there are 10 mineral licenses in the area • Active gold mine at Port Dufferin • Fishing - groundfish (including halibut) - lobster • Shellfish aquaculture in adjacent area • Some kayaking (minimal)	• Few current studies on the marine environment • CPAWS dive transects • Some provincial support for enhanced protection of the marine area

4.8 The Canso Ledges

The Canso Ledges are known historically as an important fishing ground, once having one of the world's biggest fish processing plants. However, the collapse of Atlantic cod has resulted in major economic losses for the community. Currently, only fixed gear is used for fishing in Chedabucto Bay in recognition of the need to preserve the high marine diversity and productivity that still characterises the ledges. There are numerous aggregations of marine species, from lobster and bluefin tuna to marine mammals. Several SARA-listed and COSEWIC-assessed species are found in the area.

Location and Population

The Canso Ledges is a large area located at the edge of Guysborough County near the town of Canso. The study area extends from the mainland adjacent to White Head Island to Queensport along the coast of Chedabucto Bay and wraps around the Canso Peninsula extending approximately 10 km seaward in most areas. The study area is approximately 611.9 km^2. See Figure 4.29 for a location map of the Canso Ledges. Canso is the largest town in the area with a population of 991. Canso has been experiencing substantial population decline. Since 1991 the population decreased by 25.8% (Service Nova Scotia and Municipal Relations 2006). The area has a low average population density of 0-10 people per km^2 with a significantly higher density at Canso (Municipal Services 2001).

Physical and Oceanographic Attributes

The Canso Ledges study area is one of the largest and one of few that is not confined within an embayment. The area has few coastal inlets; Dover Bay, south of Canso, and Canso Harbour make up two of the smaller water bodies in the study area. Chedabucto Bay, the largest bay in Nova Scotia, makes up a large portion of the study area. Chedabucto Bay is very deep with a depth of 107.9 m at the mouth near Canso (See Figure 4.28, DFO 2007d) and a maximum depth at the seaward extent of the study area of 146 m (CHS Charts 4013 and 4321). Canso Harbour has a maximum depth of 27.4 m. The area is tidally dominated with a high tidal to freshwater ratio of approximately 487.05:1. Canso Harbour has a high flushing time of 55.7 hours and Chedabucto Bay has a much slower flushing time of 295.3 hours (DFO 2007d). Chedabucto Bay has been classified as an intermediate pelagic bay (Greenlaw 2009). Chedabucto Bay has a watershed drainage area of 2148.4 km^2 (DFO 2007d).

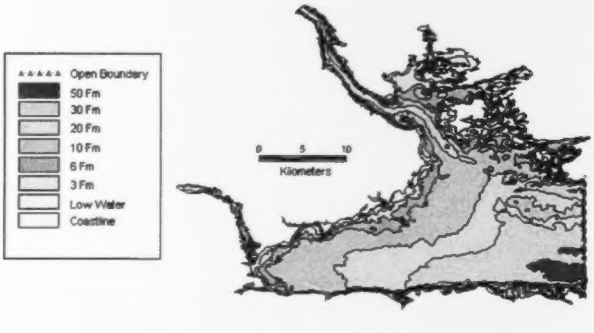
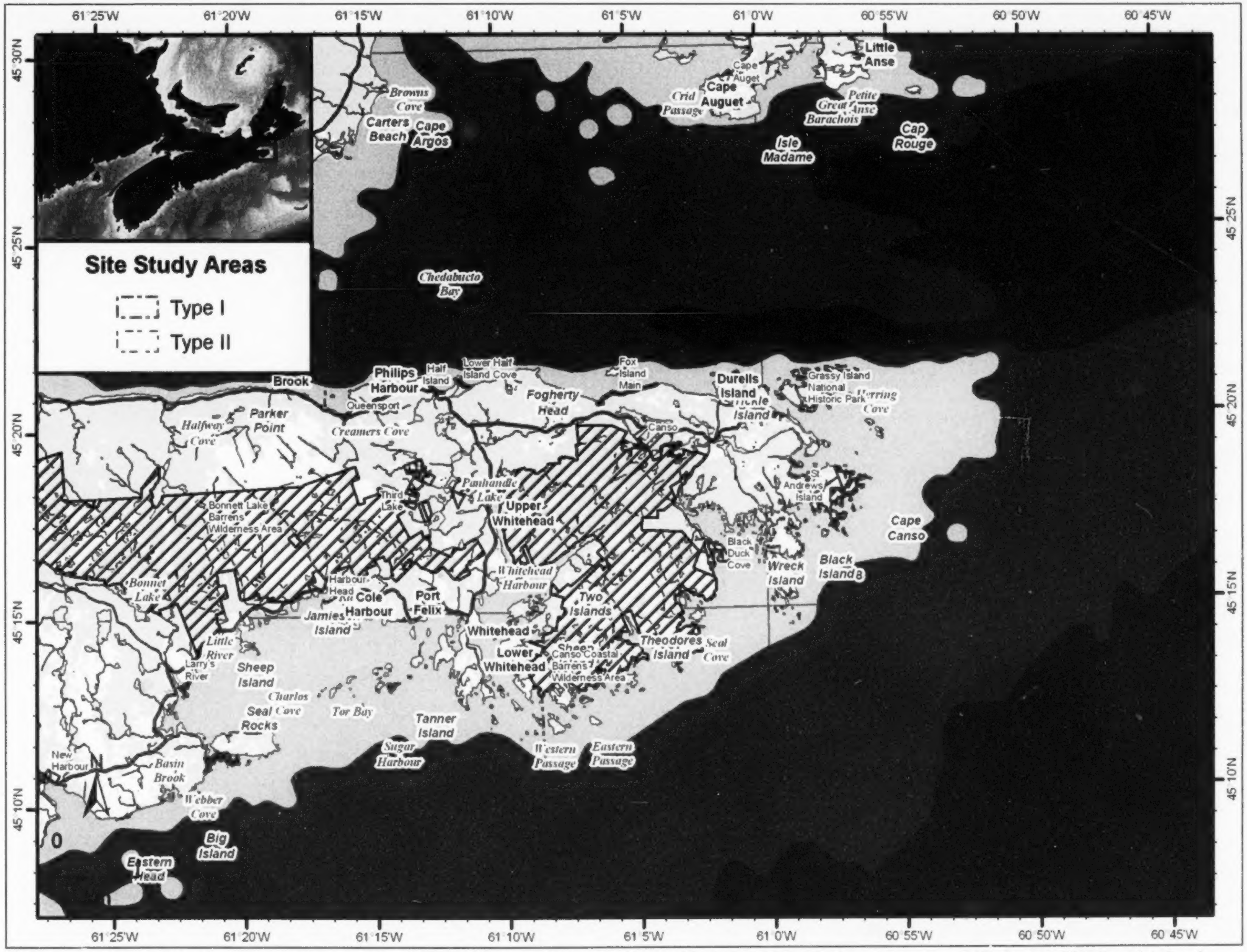


Figure 4.28 Chedabucto Bay Bathymetry (DFO 2007d)
1 Fm = 1.83 m , Coastline = intertidal zone

The terrestrial area is described as the "Canso Barrens" by Davis and Browne (1996b). Granite intrudes slates and greywacke which have all been affected by shearing along the Chedabucto fault. Extensive areas of exposed granite give the barrens the "appearance of a moonscape" (Davis and Browne 1996b). Soils are very thin or non-existent. Drumlins are found near Tor Bay and Canso, and the overall area receives a limited supply of coastal sediment (*Ibid.*). The inner Canso peninsula contains some bogs and a few coastal wetlands; the shores are rocky and the dominant primary producers are kelp and rockweed which grow well in this environment (*Ibid.*). Some of the aforementioned coastal features are illustrated in Figure 4.30. The area is moderately sensitive to sea level rise (NRCan 2007).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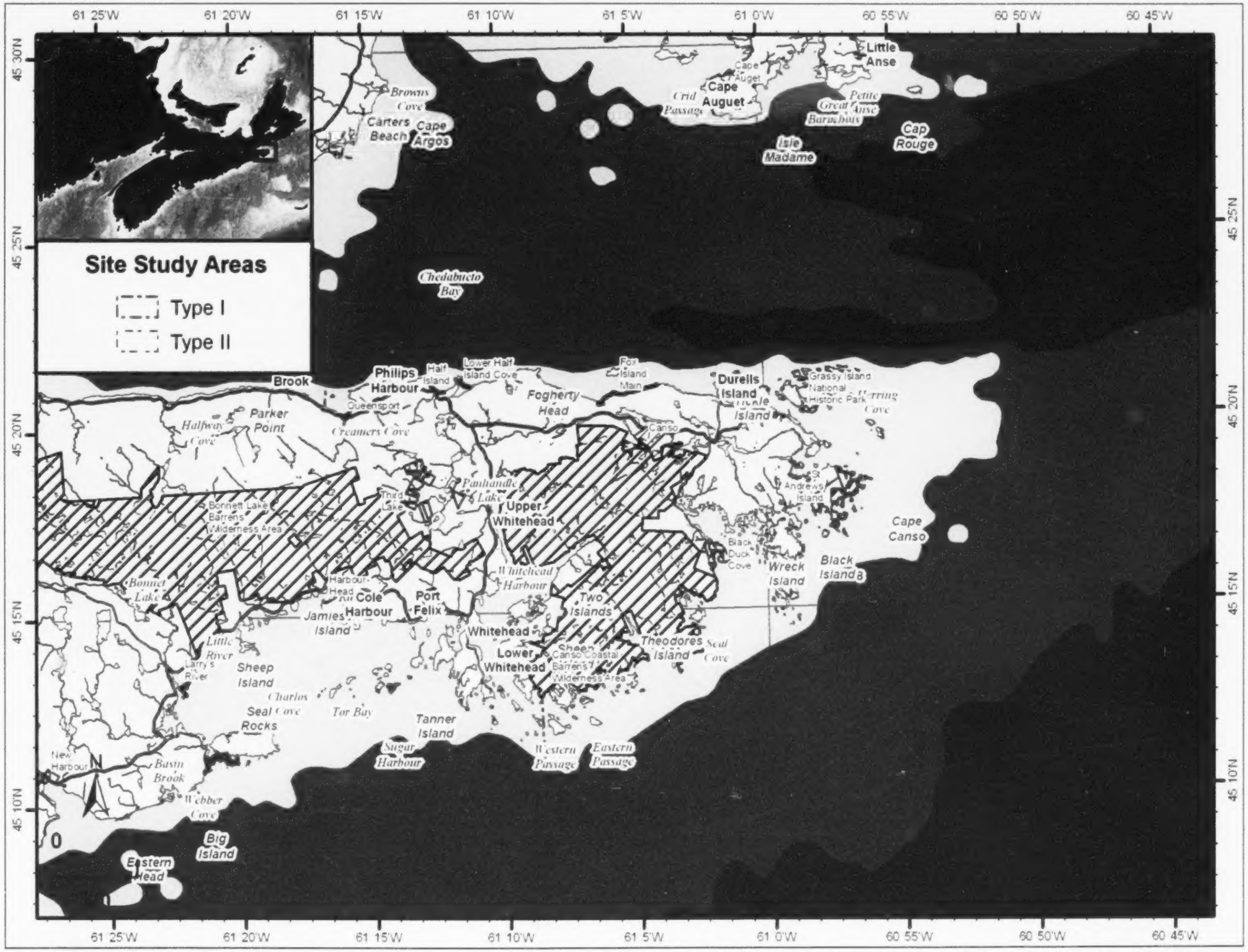
45°10'N
Site Study Areas
Type I
Type II
Little Anse
Cape Auget
Crid Passage
Cape Auguet
Petite Anse
Great Barachois
Isle Madame
Cap Rouge
Browns Cove
Carters Beach
Cape Argos
Chedabucto Bay
Brook
Philips Harbour
Half Island
Lower Half Island Cove
Fox Island Main
Durells Island
Grassy Island National Historic Park
Herring Cove
Queensport
Fogherty Head
Canso
Halfway Cove
Parker Point
Creamers Cove
Panhandle Lake
Upper Whitehead
Third Lake
St Andrews Island
Bonnett Lake Barrens Wilderness Area
Cape Canso
Black Duck Cove
Wreck Island
Black Island
Bonnet Lake
Harbour Head
Cole Harbour
Port Felix
Whitehead Harbour
Two Islands
Jamies Island
Whitehead
Lower Whitehead
Canso Coastal Barrens Wilderness Area
Theodores Island
Seal Cove
Little River
Larry's River
Sheep Island
Charlos
Seal Cove Rocks
Tor Bay
Tanner Island
Sugar Harbour
Western Passage
Eastern Passage
New Harbour
Basin Brook
Webber Cove
Big Island
Eastern Head

Figure 4.29 Location Map for the Canso Ledges (Site #8). Basemap layers: land 1: 50 000, 1: 250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); Restricted and Limited Use Land Database Layers (NSDNR 2006b). Refer to Figure 4.1 for legend.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Carters Beach
Cape Argos
Crid Passage
Cape Auget
Cape Auguet
Little Anse
Petite Anse
Great Anse
Baruchois
Isle Madame
Cap Rouge
Chedabucto Bay
Brook
Philips Harbour
Half Island
Lower Half Island Cove
Fox Island Main
Durells Island
Pickle Island
Grassy Island National Historic Park
Herring Cove
Queensport
Fogherty Head
Canso
Halfway Cove
Parker Point
Creamers Cove
Panhandle Lake
Third Lake
Upper Whitehead
Bonnett Lake Barrens Wilderness Area
St Andrews Island
Cape Canso
Black Duck Cove
Wreck Island
Black Island
Whitehead Harbour
Bonnet Lake
Harbour Head
Cole Harbour
Port Felix
Jamies Island
Two Islands
Whitehead
Lower Whitehead
Sheep
Canso Coastal Barrens Wilderness Area
Theodores Island
Seal Cove
Little River
Larry's River
Sheep Island
Charlos Cove
Seal Rocks
Tor Bay
Tanner Island
Sugar Harbour
Western Passage
Eastern Passage
New Harbour
Basin Brook
Webber Cove
Big Island
Eastern Head
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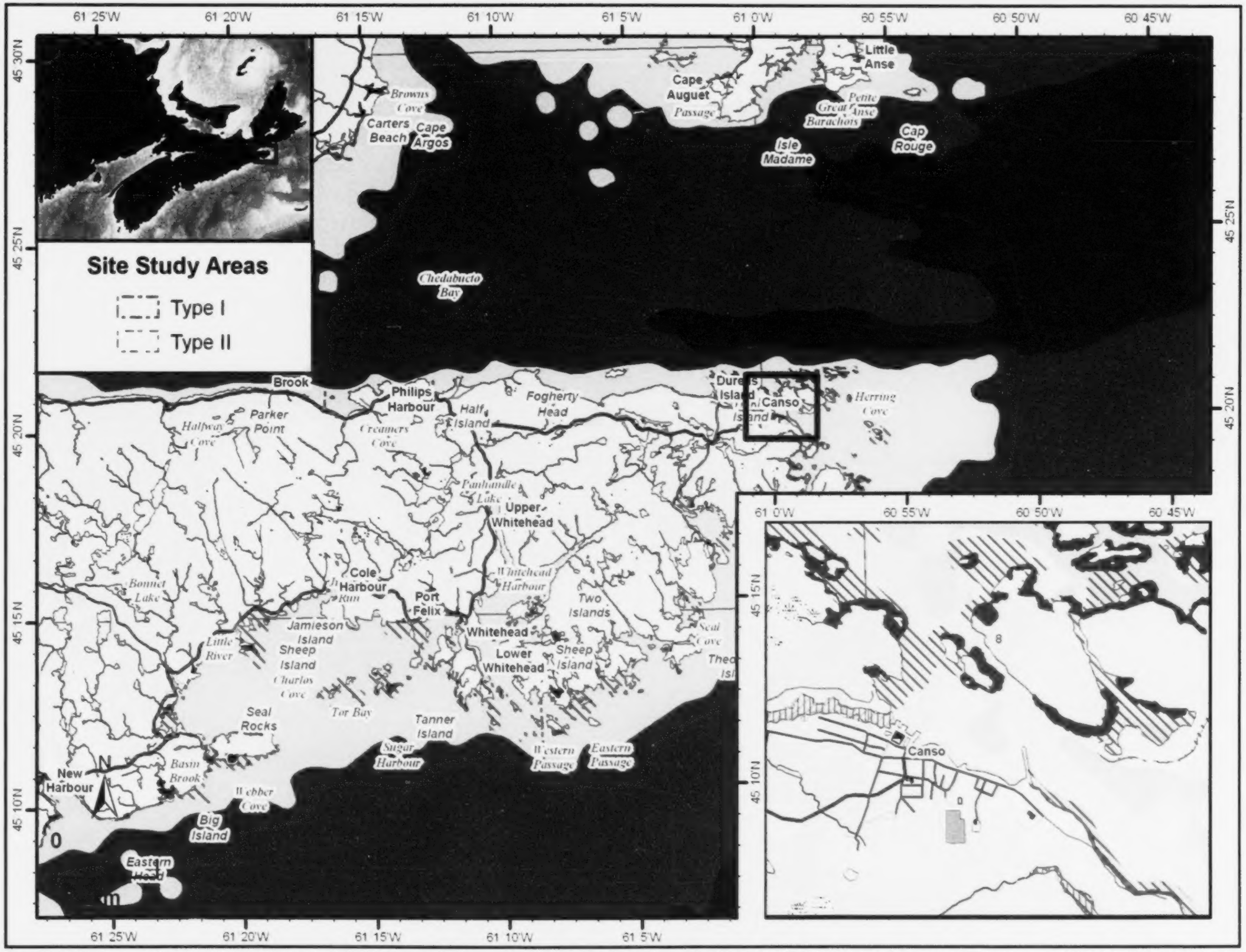
Figure 4.29 Location Map for the Canso Ledges (Site #8). Basemap layers: land 1: 50 000, 1: 250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); Restricted and Limited Use Land Database Layers (NSDNR 2006b). Refer to Figure 4.1 for legend.


Site Study Areas
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Cape Argos
Petite Anse
Great Barachois
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Brook
Philips Harbour
Half Island
Fogherty Head
Durell Island
Canso
Herring Cove
Halfway Cove
Parker Point
Creamers Cove
Panhandle Lake
Upper Whitehead
Bonnet Lake
Cole Harbour
Port Felix
Whitehead Harbour
Two Islands
Jamieson Island
Sheep Island
Little River
Charlos Cove
Whitehead
Lower Whitehead
Seal Cove
Tor Bay
Seal Rocks
Tanner Island
Sugar Harbour
Western Passage
Eastern Passage
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60 55'W
60 50'W
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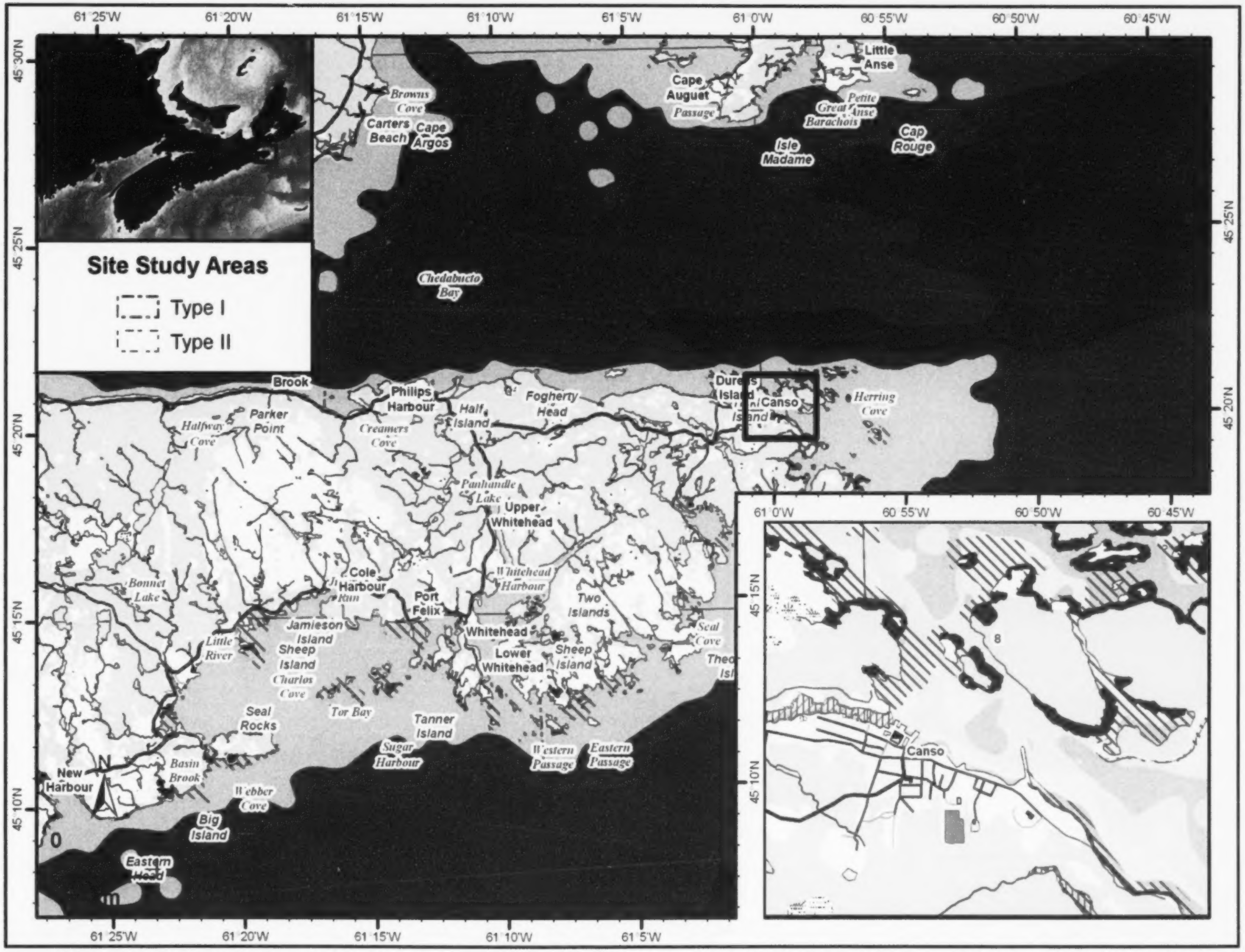
45 20'N
45 15'N
45 10'N

Figure 4.30 Coastal Habitats in the Canso Ledges (Site #8). Basemap layers: land 1:50 000, 1:250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); NSDNR Wetlands Database layers (NSDNR 2000). Refer to Figure 4.2 for legend.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Site Study Areas
Type I
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Little River
Sheep Island
Charlos Cove
Whitehead
Lower Whitehead
Sheep Island
Seal Cove
Tor Bay
Seal Rocks
Tanner Island
Sugar Harbour
Western Passage
Eastern Passage
New Harbour
Basin Brook
Webber Cove
Big Island
Eastern Head
8
Canso

Figure 4.30 Coastal Habitats in the Canso Ledges (Site #8). Basemap layers: land 1:50 000, 1:250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); NSDNR Wetlands Database layers (NSDNR 2000). Refer to Figure 4.2 for legend.

Ecological Attributes

The Canso Ledges were identified by scientific experts as an EBSA. It meets the three primary EBSA criteria and was identified three times by scientific experts in the EBSA identification process (Doherty and Horsman 2007).

The marine environment of the Canso Ledges area is highly productive, supporting a high diversity and abundance of fish (Clark 2006 *In* DFO 2006a). Extensive and diverse marine algae contribute to the primary productivity of the area (Moore *et al.* 1986). There are fewer eelgrass beds and salt marshes in this area (NSDNR 2000), compared to other areas in this analysis, due to the rocky shores which better support kelp growth.

The area is known as a former Atlantic cod and herring spawning area and it is thought that spawning still occurs, although herring spawning was not noted in the area in the 2009 Assessment of 4VWX herring (DFO 2009d). Chedabucto Bay was one of the largest spawning areas for both species in inshore Nova Scotia (Bundy *et al.* 2007; Lane and Associates 1992; Mercier 1996; DFO 2001b). Juvenile herring and hake use Chedabucto Bay as a nursery area (Lane and Associates 1992; McCullough *et al.* 2005) and herring overwinter in the area (Lane and Associates 1992). Fox Island Beach and Queensport Beach (outside the study area) were sampled for abundance and diversity of juvenile fish species in 2005 and 2006 and both areas contained abundant sand lance, hake species, and grubby (O'Connor 2008).

This area supported moderate landings of lobsters for many years but landings have increased substantially in recent years. Within Lobster Fishing Areas 29 and 31a, the catch per unit effort (CPUE) of both prerecruit and legal sized lobster increased sharply in 2003 (Tremblay *et al.* 2009) and landings increased as well. Landings have continued to increase since 2003; 2009 landings in LFA 29 were 15 times greater than those in 2002 (M.J. Tremblay, DFO Science Branch, pers. comm. 2009). These higher landings reflect higher abundance. The reason for the increase in lobster abundance in these areas has not been determined (Tremblay *et al.* 2009) but is thought to relate either to higher survival rates of young lobster or a greater supply of young lobster to the area (M.J. Tremblay, DFO Science Branch, pers. comm. 2009).

The area is an important bluefin tuna (DFO 2002a) and marine mammal feeding area (Doherty and Horsman 2007). Other aggregations of marine species are found in the area throughout the year, including overwintering mackerel, shrimp, Atlantic wolffish, snow crab, winter flounder, grey and harbour seals, harbour porpoises, white-sided dolphin, Atlantic pilot whale, fin whales, and minke whales (Koeller 2000; Koeller *et al.* 2007 *In* Bundy *et al.* 2007; Doherty and Horsman 2007; NSE 2002). Chedabucto, Mahone, and St. Margaret's Bay are known inshore areas for populations of Northern shrimp (Koeller 2000; Koeller *et al.* 2007 *In* Bundy *et al.* 2007).

The area supports several SARA-listed and COSEWIC-assessed species including the endangered fin whale (special concern, SARA) which were once known to aggregate in Chedabucto Bay in the winter but it is uncertain if this continues (Doherty and Horsman 2007), Atlantic wolffish (special concern, SARA), winter skate (threatened, COSEWIC), thorny skate (scheduled for assessment by COSEWIC) (Harris 2006 *In* DFO 2006a; Doherty and Horsman 2007), and cusk (threatened, COSEWIC) (VDC 2009). Atlantic wolffish, winter skate, and thorny skate have been found in aggregations near Canso (Harris 2006 *In* DFO 2006a).

The Canso Ledges did not meet the naturalness criteria for identifying EBSAs in the 2006 Scientific Expert Opinion workshop for identifying EBSAs, and therefore the area is assumed to have a low to moderate level of naturalness. High levels of fishing and nearby coastal development, particularly industrial development, have likely affected the naturalness of the area.

Bird Information

This area does not overlap or coincide with presently identified IBAs. Breeding species such as herring can reach numbers of national significance, while Common Eider, Great Black-backed Gull, Double-crested Cormorant as well as Common and Arctic Tern species also breed in the area in important if not significant numbers (CWS). Although eelgrass densities in the area have been assessed as intermediate, low numbers of geese and high numbers of dabbling ducks occur here. Although low numbers of bay ducks frequent this area, very high numbers of sea ducks have been observed (CWS).

Important Marine Ecological Features:

- Historic Atlantic cod and herring spawning area; spawning may still occur
- Abundance and diversity of marine species: overwintering mackerel, Northern shrimp, Atlantic wolffish, lobster, snow crab, winter flounder, grey and harbour seals, harbour porpoise, white-sided dolphin, Atlantic pilot whale, fin whale, and minke whale
- SARA-listed species: fin whale (special concern) and Atlantic wolffish (special concern)
- COSEWIC-assessed species: Atlantic cod (endangered), winter skate (threatened), thorny skate (scheduled for assessment), cusk (threatened) and harbour porpoise (special concern)
- Abundance and diversity of marine algae
- Marine mammal feeding area
- Birds: colonies, sea ducks

Human Uses

Human uses in the area are primarily terrestrial with several industrial developments outside of this current study area but within Chedabucto Bay. Marine uses include fishing, shipping, aquaculture in nearby areas, and tourism and recreation.

Coastal/Industrial Development

The population decline of Guysborough County and the effect of the Atlantic cod collapse on the area have led to large-scale industrial development and development proposals in an attempt to restore the local economy. These developments are taking place primarily within inner Chedabucto Bay in Port Hawkesbury and there is very little development in Canso as the area is experiencing population decline. However, development in Chedabucto Bay may have implications for the large Canso Ledges study area. The Municipality of the District of Guysborough has a comprehensive municipal planning strategy and associated land use bylaws (see Appendix D) (CBCL Limited 2009).

The following list describes developments that are underway or completed and the effects of some of these developments:

- Melford International Terminal – a major new container port is planned for the top of Chedabucto Bay / mouth of Strait of Canso, projected opening in 2011. MITI is developing a 315-acre deep-water container terminal, intermodal rail facility and 1500-acre logistics park (NSE 2008). This is expected to lead to a significant increase in large vessel traffic through this area (*Ibid.*).
- Proposed Liquefied Natural Gas Terminal at Point Tupper/Bear Head in the Strait of Canso. This is also a major construction that will increase large vessel traffic (NSE 2008). The LNG terminal has not been completed.
- Proposed expansion to the quarry located on Porcupine Mountain on the Strait of Canso (Guysborough County Regional Development Authority 2005).
- Potential for aggregate mining at Flagstiff Hill (Lane and Associates 1992)
- High mercury concentrations were once in the Canso area due to contamination from the Stora Enso (NewPage Corporation) pulp and paper mill at Port Hawkesbury (Lane and Associates 1992), however, no recent information is available. The facility released 42.89 tonnes of phosphorus into the water in 2007, as reported in the NPRI (Environment Canada 2008b).
- The Point Tupper power generating station emits several contaminants including arsenic, cadmium, lead, mercury, and phosphorus, as reported in the NPRI (Environment Canada 2008b).
- Other industrial developments include Georgia Pacific Inc. which mines for gypsum in the Bras d'Or Lakes and ships it from Port Hawkesbury, and Exxon Mobil's fractionation plant, both located in Port Hawkesbury (Environment Canada 2008b) and Mulgrave Machine Works
- Copper has been found onshore in Chedabucto Bay (Bundy *et al.* 2007)
- Martin Marietta quarry at Auld's Cove on the Strait of Canso (CBCL Limited 2009)
- There are several abandoned submarine cables that come to shore at the Canso Ledges (DFO 2005a).

The ecological integrity of the area was compromised in 1970 when the Liberian oil tanker ARROW ran aground causing an oil spill of 180,000 barrels of Bunker C. Fuel at Cerebrus Rock south of Isle Madame (Environment Canada 2006).

The area may have potential for wind energy development, with high wind speeds of 8.01-8.5 m/s on much of the surrounding land (Province of Nova Scotia 2010).

Commercial Fishing

Several fisheries occur in the study area including lobster, bluefin tuna, shrimp, snow crab, scallop, mackerel, and herring.

Lobster and bluefin tuna were the dominant species fished in the study area in 2007-2009. The area has high landings of bluefin tuna and is one of the primary bluefin tuna fishing areas on the Scotian Shelf (DFO 2005a; VDC 2009).

Although this is not the most important area for lobster in Nova Scotia, it is an area that has experienced a recent boom in the industry as landings have increased over the last few years (A. Silva, DFO Science Branch, pers. comm. 2009). Landings are medium relative to other sites and overall landings in DFO's Maritimes Region. In grid squares 338 and 339, the reporting units that most closely align with the study area, 2008 lobster landings are estimated at 424 MT. These landings comprise

1.42% of 2008 landings in the Maritimes Region and 44.03% of LFA 31a landings in 2008. LFA 31a comprises 3.23% of 2008 landings in the Maritimes Region (VDC 2009).

Snow crab landings are low in the immediate area with more important areas located outside the study area, on the Cape Breton side of Chedabucto Bay within 15 nautical miles (VDC 2009; M. Eagles, DFO Oceans, Habitat and Species at Risk Branch, pers. comm. 2010). Groundfish landings may be by-catch due to very low landings in the area. Atlantic cod and cusk, two COSEWIC-assessed species, are caught in the area (VDC 2009).

Chedabucto Bay as a whole is an important area for mackerel, but landings in the study area are low. The area is not important at the provincial scale for the scallop fishery; very low landings are reported (DFO 2005a; VDC 2009). Shrimp landings immediately outside Chedabucto Bay (within Shrimp Fishing Area (SFA) 15) are the highest landings within the territorial sea along the Atlantic Coast of Nova Scotia (DFO 2005a). Chedabucto Bay has the most important shrimp trap fishery in Nova Scotia and is currently the only trap fishery after a failure in experimental trapping in St. Margaret's Bay and declines in landings in Mahone Bay. However, trap-caught shrimp landings have declined in Chedabucto Bay in recent years, as indicated by 2007-2009 MARFIS data (VDC 2009). The trap-caught fishery is of low value (M. Eagles, DFO Oceans, Habitat and Species at Risk Branch, pers. comm. 2010). This may be the cause of low landings in recent years. There are currently 14 license holders for the shrimp trap fishery in Chedabucto Bay (*Ibid.*).

Herring landings were high in small areas from 1999-2003 (DFO 2005a), however, there have been no landings in recent years (VDC 2009). Mackerel landings were higher from 1999-2003 (DFO 2005a) than they were in recent years with very low landings reported (VDC 2009).

Fisheries in the Canso Ledges area are primarily landed using fixed gear (VDC 2009); the limited scallop fishery is the only mobile fishery in the area.

Canso was once home to one of the world's largest fish processing plants, which was recently closed causing economic collapse and increasing out-migration resulting in population decline. The community of Canso is still highly reliant on the fishing industry. A new, much smaller processing plant will be built to process crab and shrimp. The plant will employ approximately 50 people (CBC 2008). Table 4.15 below summarizes commercial fisheries in the Canso Ledges Area.

Table 4.15 Summary of Major Commercial Fisheries and Gear Used in and Adjacent to the Canso Ledges Area

Species	Landings*	Gear	Year	Source
Lobster	M	Trap	2008	VDC 2009
Shrimp	L	Trap	1999-2003 2007-2009	DFO 2005a VDC 2009
Bluefin tuna	H	Angling	1999-2003 2007-2009	DFO 2005a VDC 2009
Snow crab	L	Trap	1999-2003 2007-2009	DFO 2005a VDC 2009
Scallop	L	Dredge	1999-2003 2007-2009	DFO 2005a VDC 2009
Mackerel	L	Handline	1999-2003 2007-2009	DFO 2005a VDC 2009
Herring	L	Purse seine or mid-water gillnet	1999-2003	DFO 2005a

*H = high, M = medium, L = low

Shipping

Chedabucto Bay is one of two areas with designated vessel traffic service zones along the Atlantic Coast of Nova Scotia; the other is Halifax Harbour (DFO 2005a). Shipping traffic comes and goes from Port Hawkesbury (NSE 2008). Commercial shipping density is lower in the study site compared to the whole of Chedabucto Bay, and most shipping in the study area occurs along the area boundaries. Large vessel shipping within Chedabucto Bay is expected to increase significantly when the Melford Terminal is operational (NSE 2008).The terminal at Point Tupper handles several large commercial vessels including large crude carriers of up to 400,000 deadweight (Gulf of Canso Museum of Archives 2009).

Aquaculture

There are no aquaculture licenses in the immediate study area, however nearby Whitehead Harbour and Tor Bay have 11 and 2, respectively (see Figure 4.31, Service Nova Scotia 2008). All licenses are for blue mussels and/or sea scallops (*Ibid.*). Sites were sampled in both areas in 2003, 2004, and 2005 for the EMP and the leases are therefore assumed to be active (NSDFA 2006).

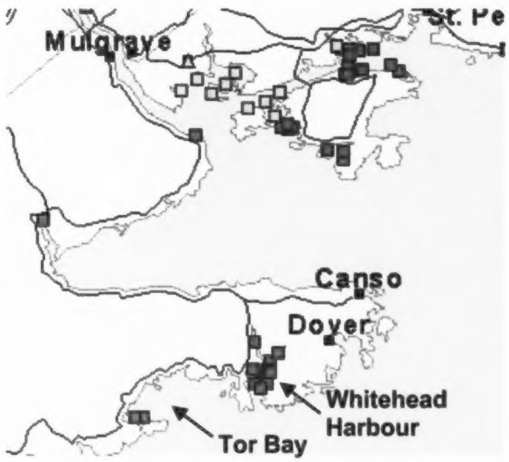

Figure 4.31 Aquaculture Licenses/Leases near Canso Ledges (denoted by green squares) (Service Nova Scotia 2008)

Tourism, Recreation, and Culture

Due to the strong historical and cultural ties to the fishing industry, Canso is visited by tourists who visit the public wharves at Queensport, Canso, Half Island Cove, Dover, Upper White Head, Port Felix, Charles Cove and Larry's River and the Cape Canso Marina which is also an attraction (CCN 2006). Grassy Island is a National Historic Site which tourists visit by boat to see the remains of the 1713 fishing community and fort established by New England merchants (Mercier 1996). Canso is home to the well-known Stan Rogers Music Festival which takes place every summer and draws over 10,000 people each year (TOC 2003). The festival is part of the economic development strategy for Canso (Stanfest 2009). There are a few bed and breakfasts, campgrounds, RV parks, and there is one motel in the area (TOC 2003). Recreational activities include camping, hiking, swimming, and kayaking.

Current Protection and Research/Conservation Initiatives

There are several terrestrial protected areas near the Canso Ledges area, some of which are very large, including:

- Canso Coastal Barrens Wilderness Area
- Grassy Island National Historic Site
- Port Shoreham Beach Provincial Park (North-west Chedabucto Bay – near Clam Harbour Bay)
- Several Protected Beaches
- Two coastal Non-designated Parks and Park Reserves near Canso Ledges
- Bonnett Lake Barrens Wilderness Area (near site but not adjacent – Tor Bay)

(Service Nova Scotia 2006; NSDNR 2006b)

The ecological importance of the area is highly recognized by several government departments. At the first meeting of CPANS, the Canso Ledges and Port Joli were identified by the most number of federal and provincial departments as areas of conservation interest. Lane and Associates (1992) recommended the Canso Offshore Islands area for further assessment by Parks Canada. The area was later confirmed as one of three representative marine areas (RMAs) of the Scotian Shelf marine region (Mercier 1996). The identification of RMAs is the first step in the NMCA process (*Ibid.*), however, Parks Canada is not currently pursuing an NMCA designation in the Scotian Shelf marine region.

Because of continued community reliance on the fishing industry, fish harvesters have taken conservation measures to protect their resources by successfully implementing an unofficial ban of mobile gear from the bay (with the exception of a few scallop draggers at the mouth of Chedabucto Bay) and through the shrimp-trap fishery. In addition to the voluntary closure, otter trawl fishing is prohibited within most of Chedabucto Bay, west of a straight line adjoining Cape Canso and Green Island as per Schedule XXXI (*s.* 106) of the Atlantic Fisheries Regulations made under the *Fisheries Act*. The Guysborough County Inshore Fisherman's Association (GCIFA) represents the inshore fish harvesters in the county and has formed research alliances with government and community organizations, the regional development authority, and St. Francis Xavier University (GCIFA 2007). Another conservation initiative is the ongoing work between the GCIFA and the Ecology Action Centre to promote sustainably harvested trap-caught shrimp caught in Chedabucto Bay (*Ibid.*).

There is considerable research conducted in this area by the GCIFA and partners, however there is little current information to support conservation planning such as information on habitat and species distribution. Research mainly pertains to lobster larvae and female tagging studies.

Canso is one of the two Natural Geography Inshore Areas Project (NaGISA) sites in Nova Scotia, the other is Port Joli. The NaGISA project is a Census of Marine Life project and has 128 sampling sites in 51 countries. NaGISA's primary goal is to establish well distributed transects from the intertidal zone to 20 m for repetition over a 50 year time frame for long-term monitoring of the biological diversity of the nearshore environment (NaGISA 2009). This work is being conducted by Angelica Silva and Melisa Wong in DFO's Science Branch. The NaGISA site in Canso is specific to the monitoring of rocky shores (A. Silva, DFO Science Branch, pers. comm. 2009). The NaGISA project may provide more information for conservation planning, however information is not currently available.

Summary

Table 4.16 below summarizes the key information provided in the site profile. The area meets many of the *Oceans Act* criteria for MPA establishment and has aggregations of several marine species and contains more SARA-listed and COSEWIC-assessed species than any other site in this report. There are many human uses in the area, especially fishing, and coastal development within Chedabucto Bay may affect the ecological integrity of the area.

Table 4.16 Summary of the Canso Ledges Site Profile

***Oceans Act* Criteria (s.35)**	**Ecological Attributes**	**Human Uses**	**Current Protection and Research Initiatives**
(a) The conservation and protection of commercial and non-commercial fishery resources, including marine mammals, and their habitats; (b) The conservation and protection of endangered or threatened marine species, and their habitats (d) The conservation and protection of marine areas of high biodiversity or biological productivity	• Historic spawning area for Atlantic cod and herring; spawning may still occur • Abundance and diversity of marine species: overwintering mackerel, Northern shrimp, Atlantic wolffish, lobster, snow crab, winter flounder, grey and harbour seals, harbour porpoise, white-sided dolphin, Atlantic pilot whale, fin whale, and minke whale • SARA species: fin whale and Atlantic wolfish • COSEWIC species: Atlantic cod, winter skate, thorny skate, cusk and harbour porpoise • Abundance and diversity of marine algae • Marine mammal feeding area • Birds: colonies, sea ducks	• Some coastal development in Canso, but high levels of industrial (and potential industrial developments) in inner Chedabucto Bay • Fishing - lobster - shrimp - bluefin tuna - snow crab - scallop - mackerel - herring • Shellfish aquaculture in adjacent area • Shipping • Some tourism and recreation	• Several adjacent terrestrial protected areas • High level of provincial and federal interest for conservation (protected area departments) • Fisheries research: GCIFA and partners • Other research: NaGISA • Little current information pertinent to conservation planning

4.9 Mira Bay and Scatarie Island

Mira Bay and Scatarie Island are well-known for their importance for seabirds. Scatarie Island has dual provincial protection: the Scatarie Island Wildlife Management Area and the Scatarie Island Wilderness Area are overlapping designations. The area also supports colonies of Leach's Storm-petrel, Black Guillemot, Common Tern, and Great Cormorants. There are spawning areas for herring, potential areas of refuge for juvenile fish, and important habitats such as marine algae and eelgrass. The area is used for some recreation and tourism and there are several fisheries in the area.

Location and Population

Mira Bay and Scatarie Island are located at the easternmost reaches of Cape Breton Island with the Laurentian Channel to the northeast. The study area begins at Kelpy Cove and ends at Bordens Cove, extending seaward to encompass Scatarie Island and also includes the large water body Morien Bay, making up an area of 356.2 km^2. The area is located in Cape Breton County with the urban centre of Sydney approximately 25 km northwest and the National Historic Site of Louisbourg 15 km to the south. Communities along the coast of Mira Bay include Main-a-Dieu, Bateston, Mira Gut, Wadden's Cove, and Port Morien (Service Nova Scotia 2006). The area has a low population density of 0-10 people per km^2 (Municipal Services 2001). Scatarie Island is uninhabited. See Figure 4.33 for a location map of the study area.

Physical and Oceanographic Attributes

The Mira Bay and Scatarie Island area is a deep-water environment that receives freshwater input from Mira River and has a large watershed drainage area of 1415.8 km^2 and a low tidal to freshwater ratio of 59.2:1 (DFO 2007d). There is virtually no intertidal zone in Mira Bay, but Morien Bay has a large intertidal zone which is partially enclosed by barrier beaches. Mira Bay has a maximum depth of 18.23 m (see Figure 4.32, DFO 2007d) and the study area as a whole has a maximum depth of 91 m (CHS Charts 4013 and 4022). The area experiences upwelling creating productive waters where marine life thrives (Davis and Browne 1996b).

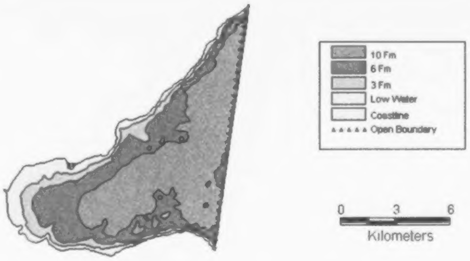

Figure 4.32 Mira Bay Bathymetry (DFO 2007d) 1 Fm = 1.83 m , Coastline = intertidal

This area of Cape Breton is characterized by its rocky coastline and poorly drained soils which results in bogs, swamps, lakes, and slow-moving streams (Davis and Browne 1996b). Mira River flows through a narrow valley with steep 20 m high banks and funnels through passages as narrow as 50 m wide towards the entrance of Mira Bay with a coastline that gradually slopes into the sea (*Ibid.*). Dunes, a barrier beach, salt marshes, and eelgrass are found in Morien Bay. Scatarie Island features bogs and barrens (*Ibid.*). Some of these features are illustrated in Figure 4.34. The coast comprises sandstone which is less suitable for kelp attachment (*Ibid.*). The area is moderately sensitive to sea-level rise (NRCan 2007). Scatarie Island is 1500 ha and is predominately owned by the province, with smaller areas owned by the federal government and private landowners (NSDNR 2009a). The Scatarie Island WMA extends one mile from the shoreline and has a total area of 6770 ha and is predominately marine (*Ibid.*). The wildlife management area has about 568 hectares of freshwater wetlands, bogs and ponds, 520 hectares of coastal forest, 323 hectares of barrens, 89 hectares of rock and beach and 10 hectares which have been cleared for lighthouses and powerline corridor (*Ibid.*).

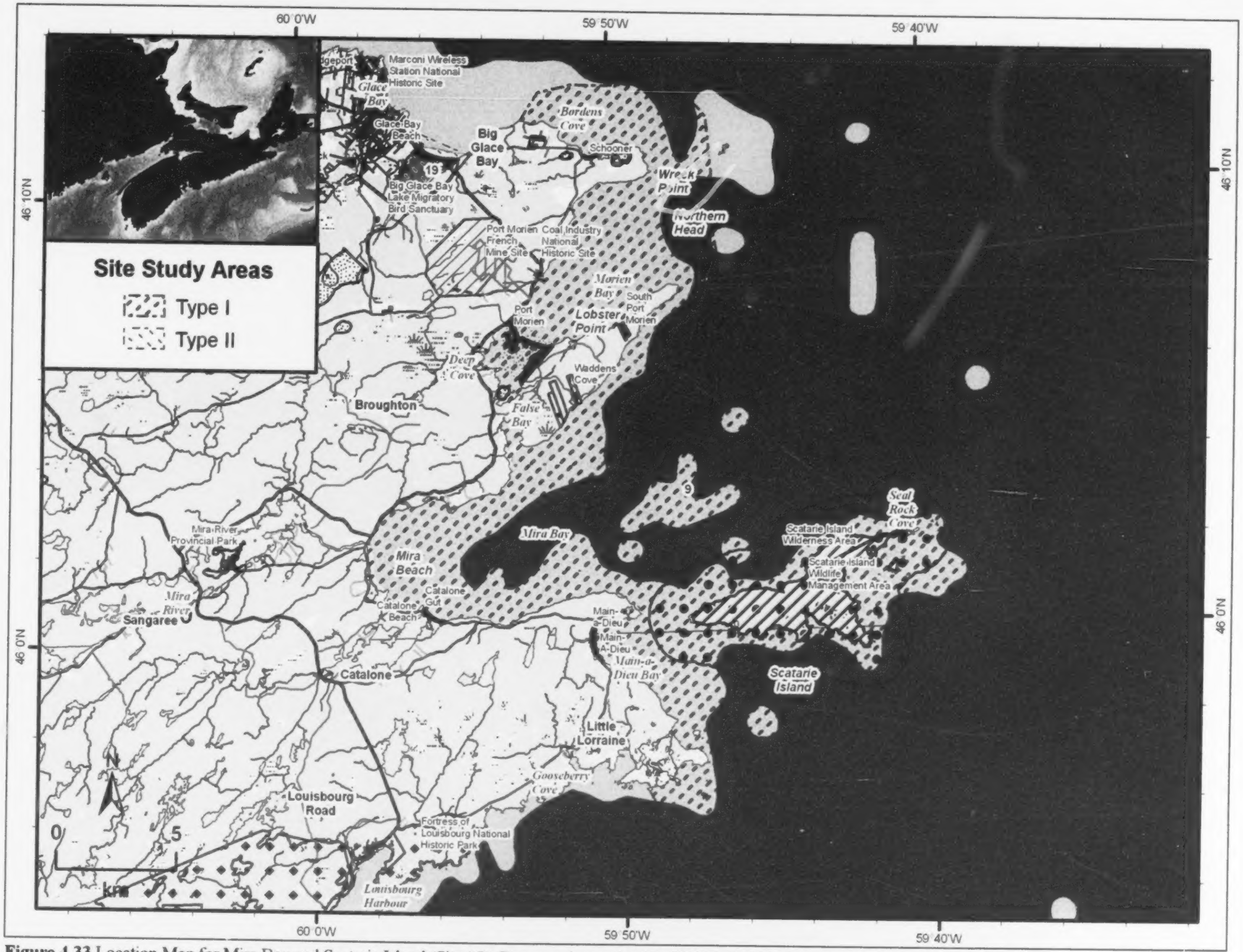
60 0'W
59 50'W
59 40'W
46 10'N
46 0'N
Site Study Areas
Type I
Type II
Marconi Wireless Station National Historic Site
Glace Bay
Glace Bay Beach
Big Glace Bay
19
Big Glace Bay Lake Migratory Bird Sanctuary
Bordens Cove
Schooner
Wreck Point
Northern Head
Port Morien French Mine Site
Coal Industry National Historic Site
Morien Bay
South Port Morien
Port Morien
Lobster Point
Deep Cove
Waddens Cove
False Bay
Broughton
9
Mira Bay
Seal Rock Cove
Scatarie Island Wilderness Area
Scatarie Island Wildlife Management Area
Mira River Provincial Park
Mira Beach
Catalone Gut
Catalone Beach
Mira River
Sangaree
Main-a-Dieu
Main-A-Dieu
Main-a-Dieu Bay
Scatarie Island
Catalone
Little Lorraine
Gooseberry Cove
Louisbourg Road
Fortress of Louisbourg National Historic Park
Louisbourg Harbour
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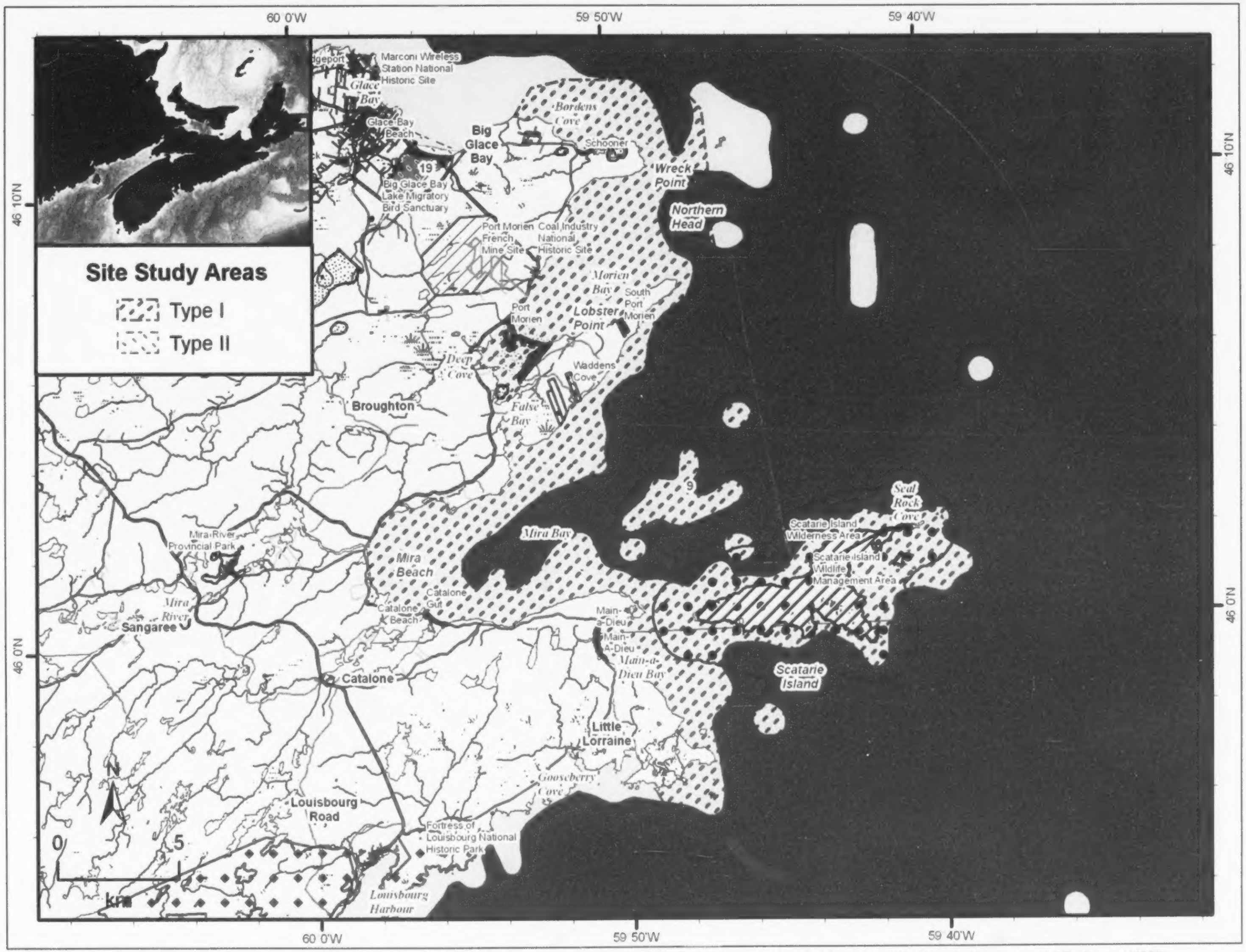
Figure 4.33 Location Map for Mira Bay and Scaterie Island (Site #9). Basemap layers: land 1: 50 000, 1: 250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); Restricted and Limited Use Land Database Layers (NSDNR 2006b). Refer to Figure 4.1 for legend.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Site Study Areas
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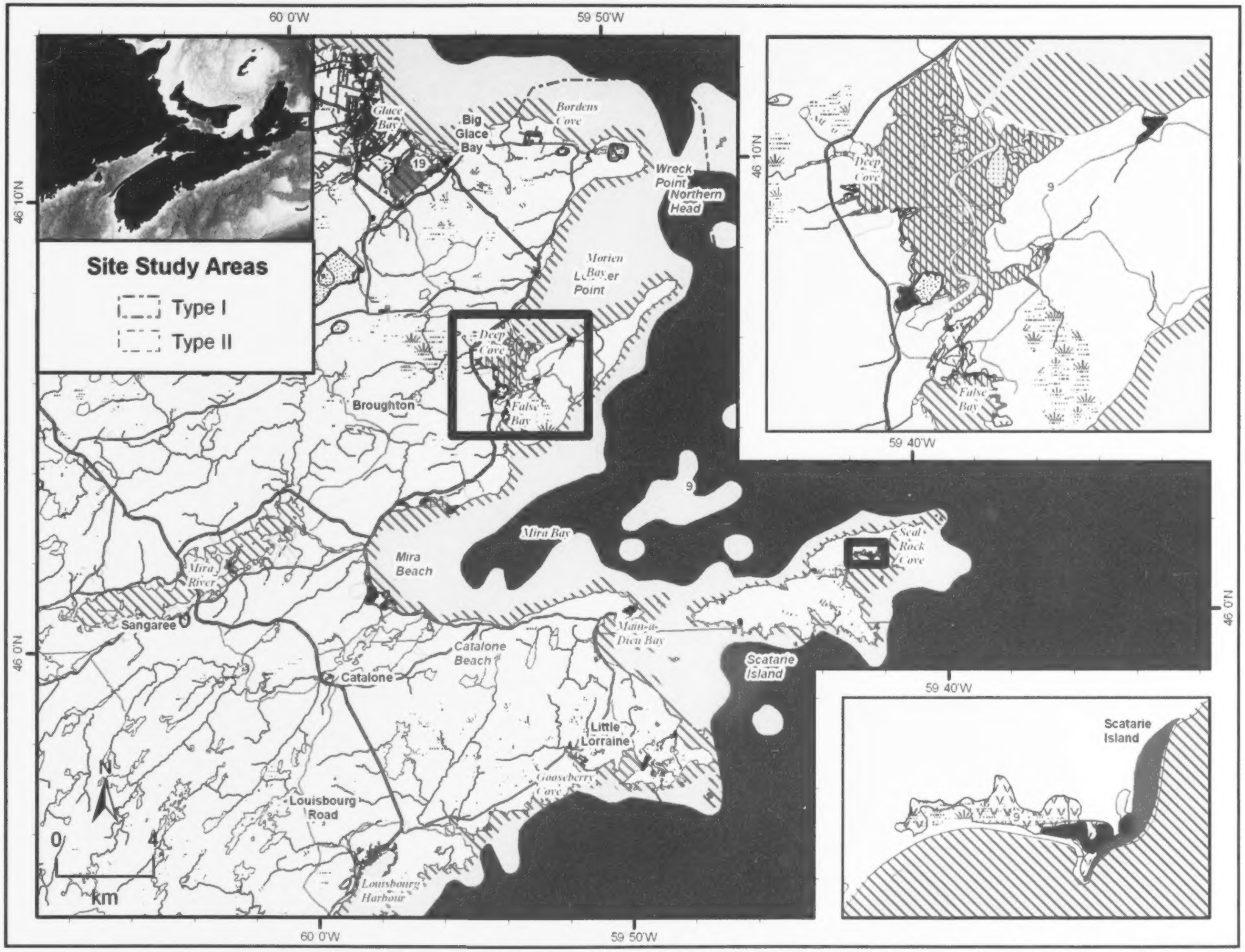
Figure 4.33 Location Map for Mira Bay and Scaterie Island (Site #9). Basemap layers: land 1: 50 000, 1: 250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); Restricted and Limited Use Land Database Layers (NSDNR 2006b). Refer to Figure 4.1 for legend.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59 50'W
46 10'N
46 0'N
59 40'W
Site Study Areas
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Type II
Glace Bay
Big Glace Bay
19
Bordens Cove
Wreck Point
Northern Head
Morien Bay
Lower Point
Deep Cove
False Bay
Broughton
9
Mira Bay
Mira Beach
Mira River
Sangaree
Seal Rock Cove
Main-a-Dieu Bay
Catalone Beach
Catalone
Scatarie Island
Little Lorraine
Gooseberry Cove
Louisbourg Road
Louisbourg Harbour
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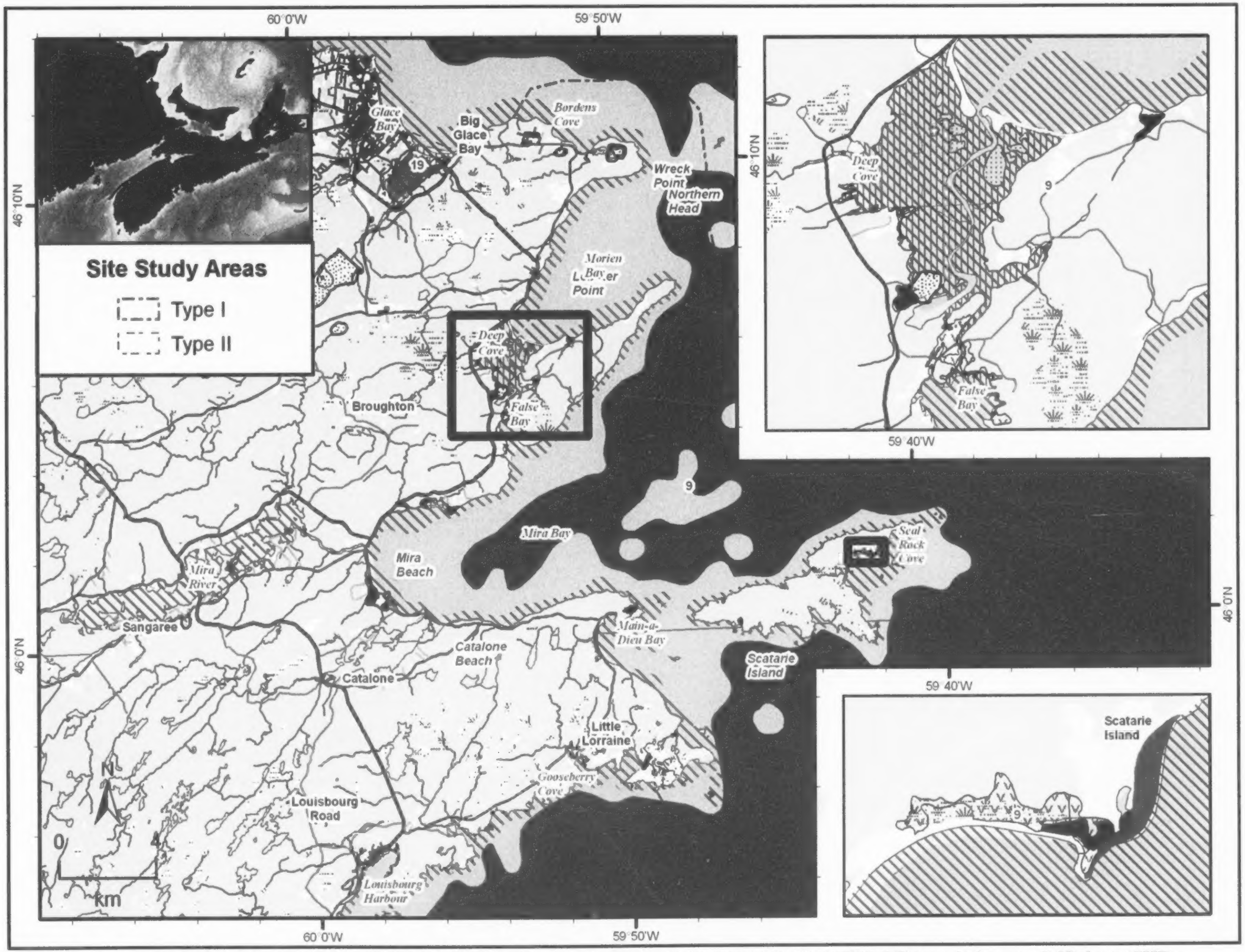
km

Figure 4.34 Coastal Habitats in Mira Bay and Scaterie Island (Site #9). Basemap layers: land 1:50 000, 1:250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); NSDNR Wetlands Database layers (NSDNR 2000). Refer to Figure 4.2 for legend.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Site Study Areas
Type I
Type II
Glace Bay
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19
Bordens Cove
Wreck Point
Northern Head
Morien Bay
Lower Point
Deep Cove
False Bay
Broughton
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Mira Bay
Mira Beach
Mira River
Sangaree
Seal Rock Cove
Main-a-Dieu Bay
Scatarie Island
Catalone Beach
Catalone
Little Lorraine
Gooseberry Cove
Louisbourg Road
Louisbourg Harbour
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Figure 4.34 Coastal Habitats in Mira Bay and Scaterie Island (Site #9). Basemap layers: land 1:50 000, 1:250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); NSDNR Wetlands Database layers (NSDNR 2000). Refer to Figure 4.2 for legend.

Ecological Attributes

Mira Bay and Scatarie Island were identified by scientific experts as an EBSA. It meets all of the EBSA criteria from a medium to high degree (it is considered highly resilient, unique, and has high aggregations). Scatarie Island and Mira Bay were identified three to four times by scientific experts in the EBSA identification process whereas many other areas were identified only one or two times (Doherty and Horsman 2007).

Scatarie Island is an IBA and is a designated Wilderness Area overlapped with a WMA for the protection of nesting and migratory bird colonies including Leach's Storm-petrel, Black Guillemot, Common Tern, Great Cormorant, and is perhaps one of 45 nesting locations for Kittiwakes in Nova Scotia (Doherty and Horsman 2007; Schaefer *et al.* 2004). Morien Bay is the most significant area for shorebirds in Cape Breton (Schaefer *et al.* 2004).

Other than its importance for birds, Scatarie Island and Mira Bay have an abundance of marine life, however less is known of the marine environment. Herring spawn in False Bay (DFO 2001b; Highland Coastal Mapping Association 2001). There is also lobster and scallop bottom, extensive rock crab habitat, and oysters in the area (Schaefer *et al.* 2004; Doherty and Horsman 2007). Hay Island has the largest grey seal breeding colony along the Atlantic coast of Nova Scotia according to aerial surveys conducted in January 2007 (Lidgard 2007 *In* DFO 2007c).

The area is home to two COSEWIC-assessed species, Atlantic cod (endangered) and the Red Knot (*rufa* spp.; endangered). There is also a distinct population of Lake Whitefish in Mira River which COSEWIC assessed in 2003 and considered "Data Deficient" (COSEWIC 2009).

There is indication that the area is high in biodiversity. In a study by Bundy (2007) Mira Bay was one of three sites with the highest diversity of species caught in transect gillnets. However, the gillnet samples were not as representative as the other sampling methodologies used, and therefore high biodiversity may not be an attribute of this area (A. Bundy, DFO Science, unpublished data). King (2004) noted that species diversity in the area was above mean values.

The area is productive, as it has coastal upwelling associated with the mixing of the Laurentian Channel waters with those of the Scotian Shelf (DFO 2006a). Eelgrass beds are localized to small areas along the coast; Morien Bay has the most extensive salt marsh and eelgrass habitat which are located behind a barrier beach. There are also eelgrass beds located in Mira Gut (Doherty and Horsman 2007; Schaefer *et al.* 2004). There are some diverse and abundant marine algae communities in the area (Moore *et al.*1986), however, information is outdated.

The area has a medium degree of naturalness, as determined in the 2006 EBSA workshop (Doherty and Horsman 2007), likely due to moderate levels of fishing and recreation and tourism.

Bird Information

This site fully encompasses the Scatarie Island (Number NS052), Northern Head and South Head (Number NS053) IBAs, and could include, with a slight boundary change six km to the west, the Portnova Islands IBA (Number NS006). Great Cormorants breeding within colonies in the area achieve total numbers reaching continental if not global significance, as do breeding Great Black-backed Gulls (BLI 2009). Other breeding species found here in important if not significant numbers include Herring Gull, Double-crested Cormorant, and Black Guillemot. If the boundary to the south and west were adjusted to encompass Baleine Islet, a provincially important Black-legged Kittiwake colony would be included in the area of interest. High shorebird numbers of several species have been observed in the Morien Bay, Phalen Bar area during migration. Among them, Red Knot (*rufa* spp.; endangered, COSEWIC; CWS) have been recorded at this site. High eelgrass densities, although limited in extent, can be found here. The northern part of the site, near Wreck Point, can host very high numbers of both geese and dabbling ducks. Very high numbers of dabbling ducks have also been recorded within Mira Bay. Very high numbers of bay ducks occur only north of Wreck Point, while very high numbers of sea ducks can be found around Scatarie Island.

Important Marine Ecological Features:

- Herring spawning area
- Lobster and scallop bottom, extensive rock crab habitat, oysters in the area
- Largest grey seal breeding colony on the Atlantic coast of Nova Scotia
- COSEWIC-assessed species: Atlantic cod (endangered) and Red Knot (*rufa* spp.; endangered)
- Extensive and dense eelgrass beds and salt marshes in Morien Bay
- Birds: IBA(2), shorebirds, colonies of Great Cormorants and Great Black-backed Gulls (numbers reaching continental if not global significance), geese, dabbling ducks, bay ducks, sea ducks, and colonies

Human Uses

Coastal development (although low), fishing, tourism, and recreation are the only human uses in the area.

Coastal Development

Coastal development is low with a low population density and other industries do not affect this area of Sydney Bight (Schaefer *et al.* 2004). The surrounding Cape Breton Regional Municipality has a comprehensive municipal planning strategy and associated land use bylaws (see Appendix D) (CBCL Limited 2009).

The area may have potential for wind energy development, with high wind speeds of 8.01-9.0 m/s on Scatarie Island and speeds of 7.51-8.5 on much of the surrounding mainland (Province of Nova Scotia 2010).

Commercial Fishing

According to the DFO Human Use Atlas (DFO 2005a), major fisheries in the area were mackerel, lobster, and scallop. The DFO Human Use Atlas (DFO 2005a) data differ from the current 2007-2009 data obtained from DFO's MARFIS database, and may indicate an increase in snow crab and urchin fishing activity in recent years. Currently, the major fisheries are sea urchins, rock crab, scallops, and snow crab, making up 36%, 35%, 12%, and 6% of total landings in the surrounding area, respectively. Urchins are caught by divers, scallops by draggers, and the crabs are caught with traps (VDC 2009).

According to current DFO's MARFIS database, there is not a herring roe fishery in the area and the only herring fishery is located outside the study area. Schaefer *et al.* (2004) indicated that Port Morien had some of the highest mackerel catches in Cape Breton. Catches in 2007 were much lower on a provincial scale (VDC 2009). The scallop fishery has low landings but covers an extensive area of Mira Bay (*Ibid.*).

LFA 27 is one of the most productive lobster fishing areas in the Maritimes Region, with the third highest landings (LFA 34 has the highest landings and LFA 33 the second highest) (VDC 2009), however most landings occur in central Sydney Bight (Schaefer *et al*. 2004). Lobster landings are medium in this area. In grid squares 350 and 351, the reporting units that most closely align with the study area, 2008 lobster landings are estimated at 532 MT. These landings comprise 1.79% of 2008 landings in the Maritimes Region and 19.70% of LFA 27 landings in 2008. LFA 27 comprises 9.06% of 2008 landings in the Maritimes Region (VDC 2009).

There is blood and sand worm harvesting in False Bay and Mira Bay although quantities are unknown (Bundy *et al.* 2007). Low to medium levels of oysters are harvested in Mira Bay, False Bay, Deep Cove and other areas within the study area (M. Butler, Fisheries and Aquaculture Management Branch, pers. comm. 2010). Hay Island is the location of the annual seal hunt and 200 grey seal pups were taken from the area in 2009.

There is one fish processing plant at Morien Bay and there is one outside the study area near Louisburg. There is one Small Craft Harbour, one community wharf and one government or private wharf in the area (CCN 2006).

Table 4.17 below summarizes commercial fisheries in the Mira Bay/Scatarie Island Area.

Table 4.17 Summary of Major Commercial Fisheries and Gear Used in and Adjacent to the Mira Bay/Scatarie Island Area

Species	Landings*	Gear	Year	Source
Urchins	H	Divers	2007-2009	VDC 2009
Rock crab	H	Trap	1999-2003 2007-2009	DFO 2005a VDC 2009
Snow crab	L	Trap	2007-2009	VDC 2009
Scallop	L	Dredge	1999-2003 2007-2009	DFO 2005a VDC 2009
Mackerel	L	Handline	1999-2003 2007-2009	DFO 2005a VDC 2009
Lobster	M	Trap	2008	VDC 2009

*H = high, M = medium, L = low

Aquaculture

There are five oyster aquaculture licenses in the area, and all are within Mira River close to the entrance to Mira Bay (see Figure 4.35, Service Nova Scotia 2008). The licenses make up a total lease area of 11.99 ha (0.12 km^2) (*Ibid.*). None were recently sampled through the EMP and it is therefore undetermined if the leases are currently active (NSDFA 2006).

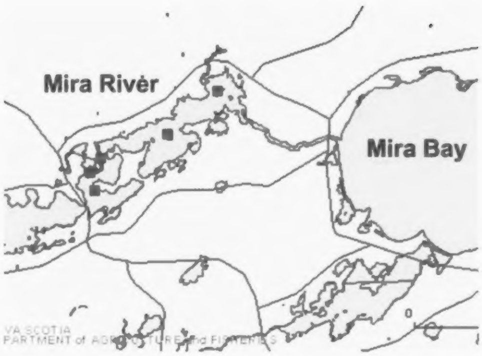


Figure 4.35 Aquaculture Licenses/Leases in Mira River (denoted by green squares) (Service Nova Scotia 2008)

Tourism, Recreation, and Culture

Although Scatarie Island is uninhabited, the island is used for tourism and recreation where hunting, kayaking, camping, and bird watching are common activities (BSC 2009), despite the dual protected status of the island. There is potential that continued uncontrolled access to the island could disturb nesting and migrating birds and damage their habitat (*Ibid.*). Although the area experiences tourism and recreation, there are only a few amenities for tourism in the area including one cottage rental, one Bed & Breakfast, a Provincial Park, a campground, a wildlife park, one restaurant, and one museum (CCN 2006). The Fortress of Louisburg National Historic Park is approximately 15 km from Main-a-Dieu (*Ibid.*).

The area has a very low population and is sparsely populated with fishing villages and summer homes around Mira River. Small farms were settled by Acadians along the Mira River and salmon and trout fishing began with the Mi'kmaq (Davis and Browne 1996b). There is a First Nation Reserve, Caribou Marsh, located inland.

Scatarie Island has a long history of fishing and was once a fishing settlement (NSE 2003). Although the settlements are abandoned, the area is visited by tourists and nearby residents who often kayak to the island to picnic and hike (*Ibid.*).

Current Protection and Research/Conservation Initiatives

There are several protected areas offering terrestrial protection, including Scatarie Island itself which is a Wilderness Area overlapped with a WMA that includes a marine portion. The area is also an IBA, although this is not legislated protection. Other protected areas include:

- EHJV Lands at Waddens Cove
- Non-designated Parks and Park Reserve at Gatalone Beach
- Main-a-Dieu Protected Beach across from Scatarie Island
- Fortress of Louisbourg National Historic Site nearby but not adjacent to coast

(NSDNR 2006b; Service Nova Scotia 2006)

Research of the marine environment is relatively deficient, although trawl survey data for the area are available and is being used in the offshore Area of Interest (AOI) analysis, in which areas are being identified as potential MPA candidates under the *Oceans Act*. A large offshore area directly to the northeast of Scatarie Island, St. Anns Bank, has been identified as one of three potential AOIs that are undergoing public and stakeholder consultation for the selection of one AOI on the Scotian Shelf (DFO 2009b).

Inshore information of the area is deficient, particularly the state and extent of eelgrass and marine plants. However, research was recently completed in the area involving LEK mapping of significant habitats and fishery-independent research which involved transect sampling of 10 sites in Nova Scotia, one of which was Gabarus and Mira Bay (Bundy 2007 *In* DFO 2007c).

Summary

Table 4.18 below summarizes the key information provided in the site profile. Although there is limited marine information available for this report, data have recently been collected in the form of LEK surveys and fishery-independent surveys which may help to inform the ecological significance of the area. Based on the information available, the area as a whole meets two of the *Oceans Act* criteria for MPA establishment.

Table 4.18 Summary of Mira Bay/Scatarie Island Site Profile

***Oceans Act* Criteria (s.35)**	**Ecological Attributes**	**Human Uses**	**Current Protection and Research Initiatives**
(a) The conservation and protection of commercial and non-commercial fishery resources, including marine mammals, and their habitats; (b) The conservation and protection of endangered or threatened marine species, and their habitats	• Herring spawning area • Lobster and scallop bottom, extensive rock crab habitat, oysters in the area • Largest grey seal breeding colony on the Atlantic coast of Nova Scotia • COSEWIC species: Atlantic cod and Red Knot • Extensive and dense eelgrass beds and salt marshes in Morien Bay • Birds: IBA (2), shorebirds, colonies of Great Cormorants and Great Black-backed Gulls (numbers reaching continental if not global significance), geese, dabbling ducks, bay ducks, and sea ducks	• Low level of coastal development • Fishing - lobster - urchins - rock crab - scallops - snow crab - mackerel - seals - oysters • Potential oyster aquaculture adjacent to area • Tourism and recreation including hunting	• Some adjacent protection on land • Current research: IEP (LEK mapping and fishery-independent surveys) • Potential AOI in the offshore area adjacent to Scatarie Island

4.10 The Bird Islands

The Bird Islands are recognized for their significance for birds. The islands were recently designated a WMA and are also a designated IBA. The islands provide nesting habitat to the largest Great Cormorant population in North America. Although the islands are well-known for their importance for birds, the surrounding waters are also rich in marine life. The islands are two of very few islands in the shallow Western Sydney Bight area and therefore serve as an important migration route for several fish and mammal species. The islands are located at the end of one of the main routes for both migration and water flow in and out of the Bras d'Or Lakes.

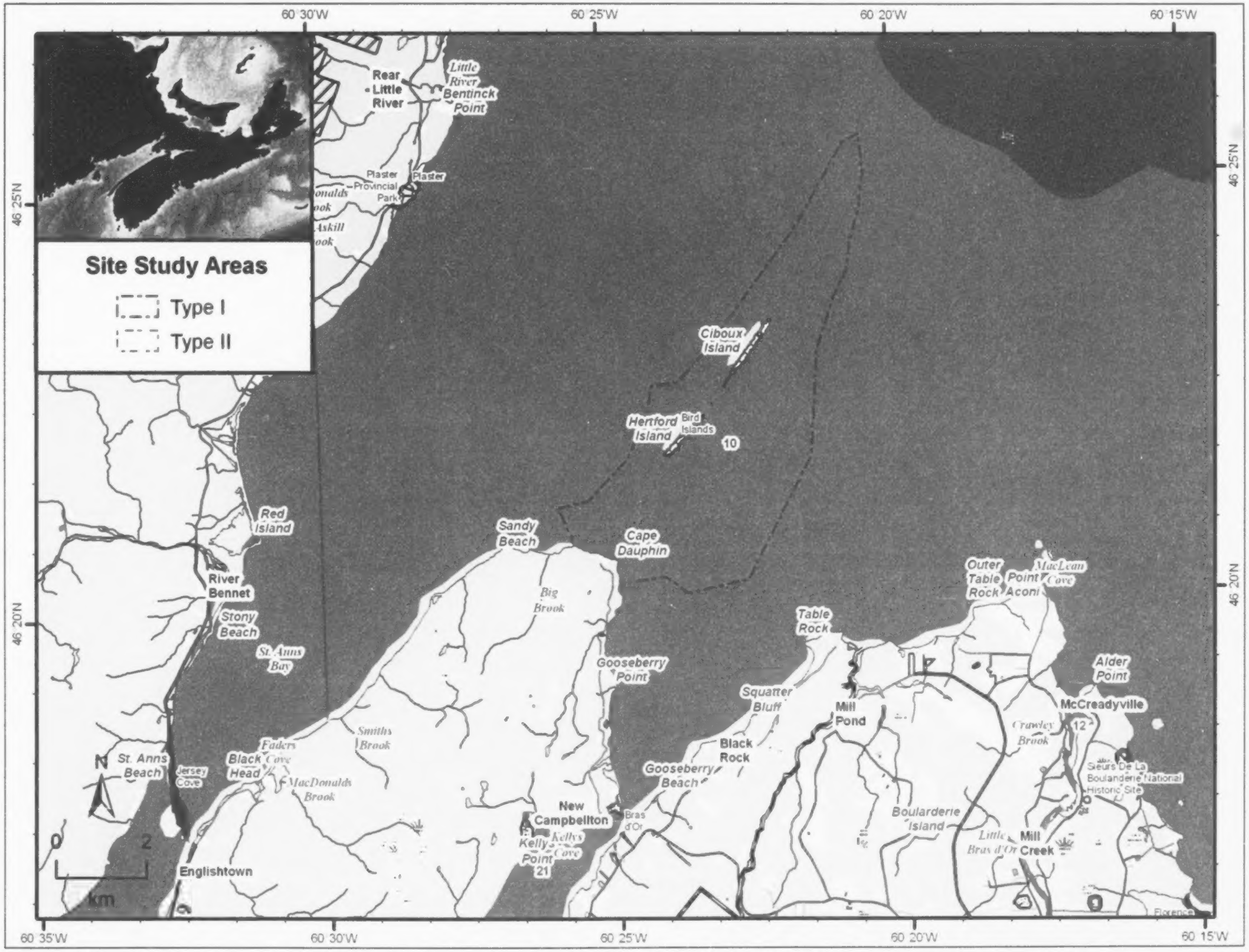
Location and Population

The Bird Islands are located off northern Cape Breton Island, approximately 4 km offshore of Cape Dauphin in St. Anns Bay, and are two long narrow islands oriented linearly in a northeast direction (Dietz and Chiasson 2000). Two islands make up the Bird Islands, Hertford and Ciboux with a length of 1.3 km and 1.6 km respectively, and each with a maximum width of 150 m (*Ibid.*). The total surface area of the two islands combined is approximately 300 ha (3 km^2) (*Ibid.*) and the marine portion of the study area is 26.2 km^2. See Figure 4.36 for a location map of the Bird Islands; the newly designated WMA is not shown. The islands are uninhabited and the nearest mainland has a very low population density of 0-10 people per km^2 (Municipal Services 2001).

Physical and Oceanographic Attributes

The Bird Islands are prone to rapid erosion but the seabed is composed of sandstone and shale which is more resistant to erosion (Dietz and Chiasson 2000). Rocks have fallen on the seabed surrounding the islands which have become shoals covered with algae and moss (*Ibid.*). The islands consist of coastal cliffs, grasslands, and stunted trees (*Ibid.*) and are moderately sensitive to sea level rise (NRCan 2007). The islands are surrounded by marine flats, as indicated in Figure 4.37 (NSDNR 2000).

The study area has an average depth of approximately 20-25 m with a maximum depth of approximately 55 m (CHS Chart 4367). Water depths close to the islands range from 20 m on the eastern side to 40 m on the western side (Dietz and Chiasson 2000). The area is influenced by the Gulf of St. Lawrence waters which are warm in the summer and cold in the winter, sometimes carrying sea ice (Davis and Browne 1996b).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Rear Little River
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Askill Brook
Ciboux Island
Hertford Island
Bird Islands
10
Red Island
River Bennet
Stony Beach
St. Anns Bay
Sandy Beach
Cape Dauphin
Big Brook
Gooseberry Point
Outer Table Rock
Point Aconi
MacLean Cove
Table Rock
Alder Point
McCreadyville
Squatter Bluff
Mill Pond
Black Rock
Gooseberry Beach
Crawley Brook
12
Sieurs De La Boularderie National Historic Site
Boularderie Island
Little Bras d'Or
Mill Creek
Smiths Brook
Faders Cove
Black Head
MacDonalds Brook
St. Anns Beach
Jersey Cove
New Campbellton
Kellys Cove
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Bras d'Or
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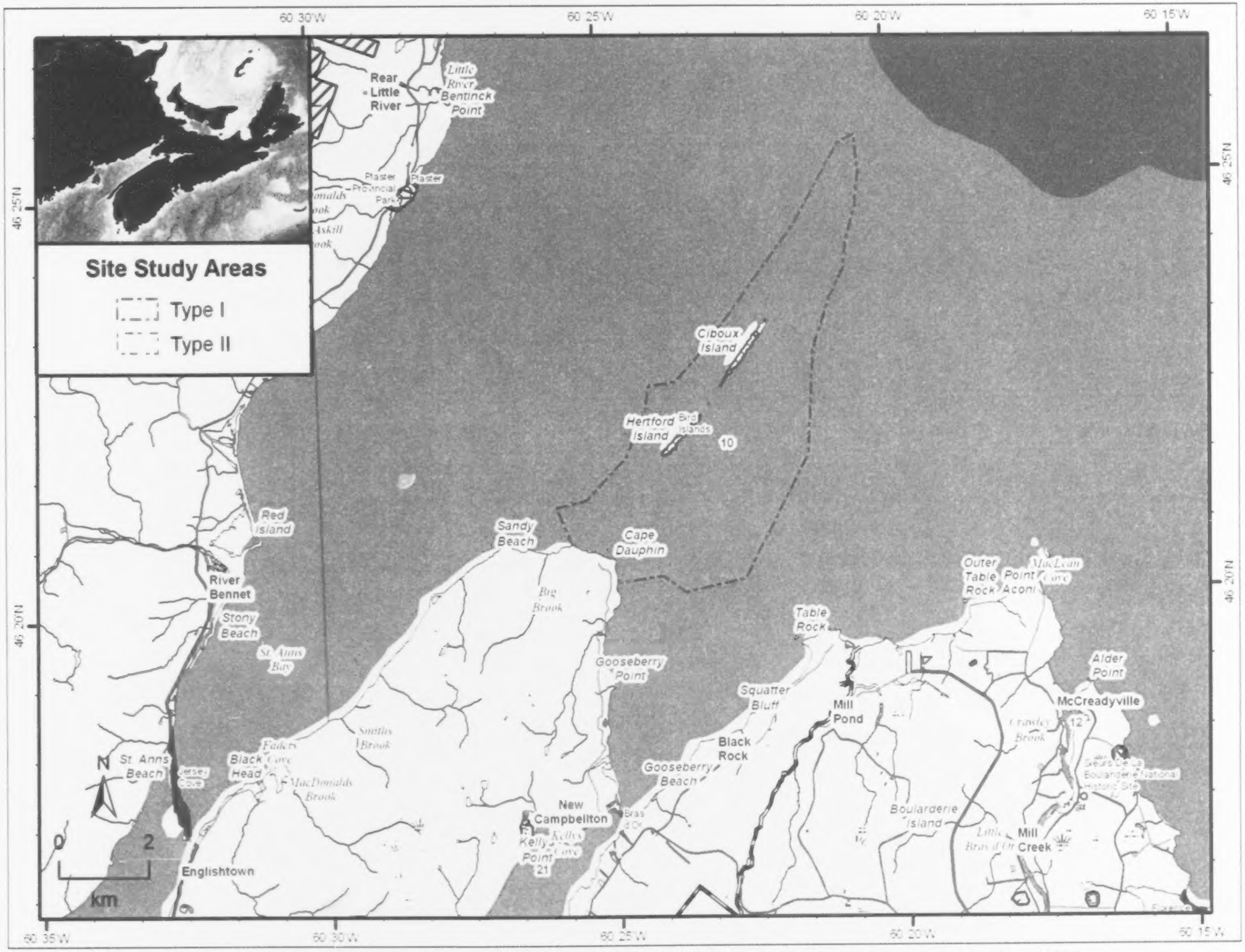
Figure 4.36 Location Map for the Bird Islands (Site #10). Basemap layers: land 1: 50 000, 1: 250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); Restricted and Limited Use Land Database Layers (NSDNR 2006b). Refer to Figure 4.1 for legend.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Plaster Provincial Park
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Askill Brook
Ciboux Island
Hertford Island
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River Bennet
Stony Beach
St. Anns Bay
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Outer Table Rock
Point Aconi
MacLean Cove
Table Rock
Gooseberry Point
Squatter Bluff
Mill Pond
Alder Point
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Jersey Cove
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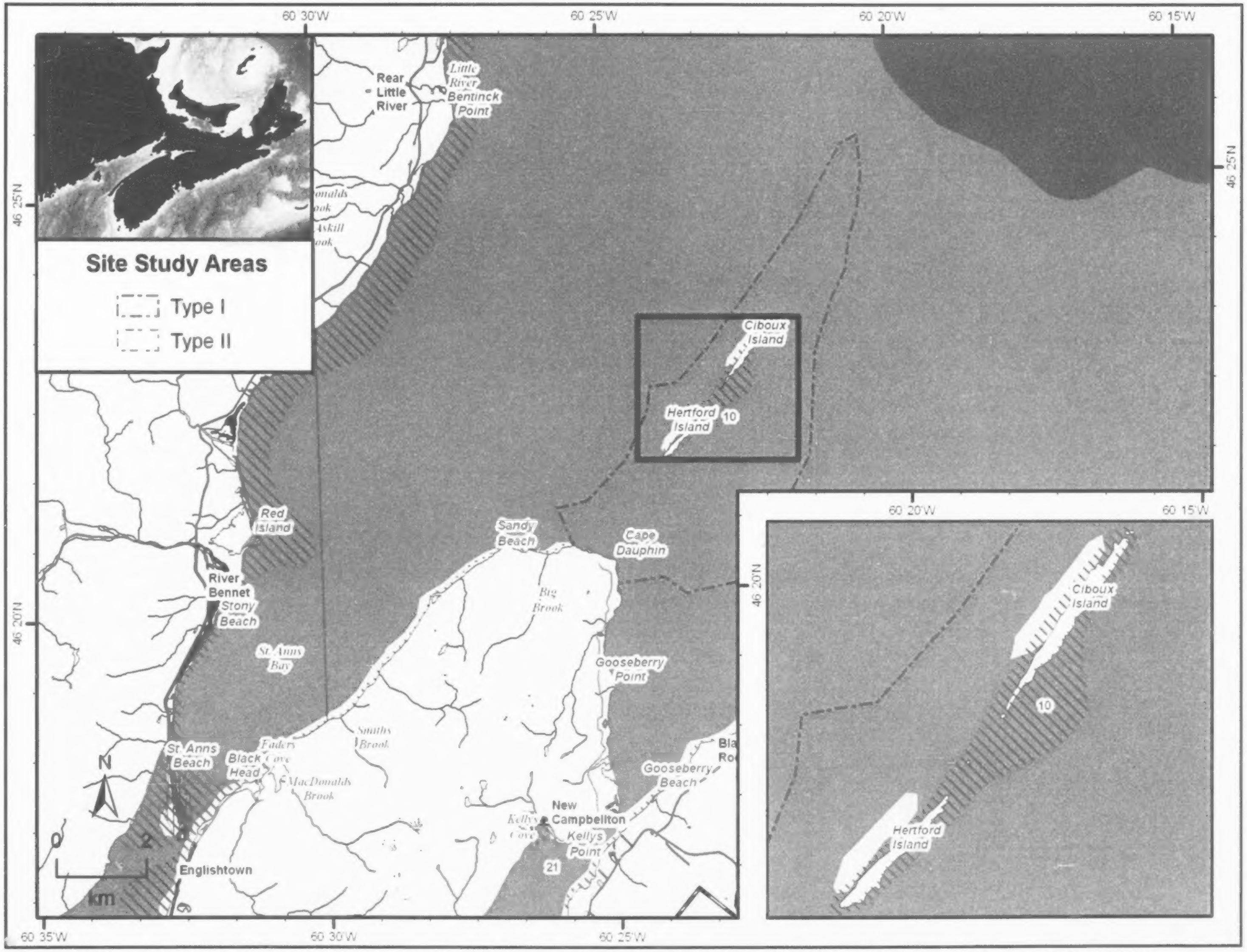
Figure 4.36 Location Map for the Bird Islands (Site =10). Basemap layers: land 1: 50 000, 1: 250 000 NTDB (NRCan), bathymetry S-57 charts (CHS), Restricted and Limited Use Land Database Layers (NSDNR 2006b). Refer to Figure 4.1 for legend.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Black Head
Faders Cove
MacDonalds Brook
Smiths Brook
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Cape Dauphin
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New Campbellton
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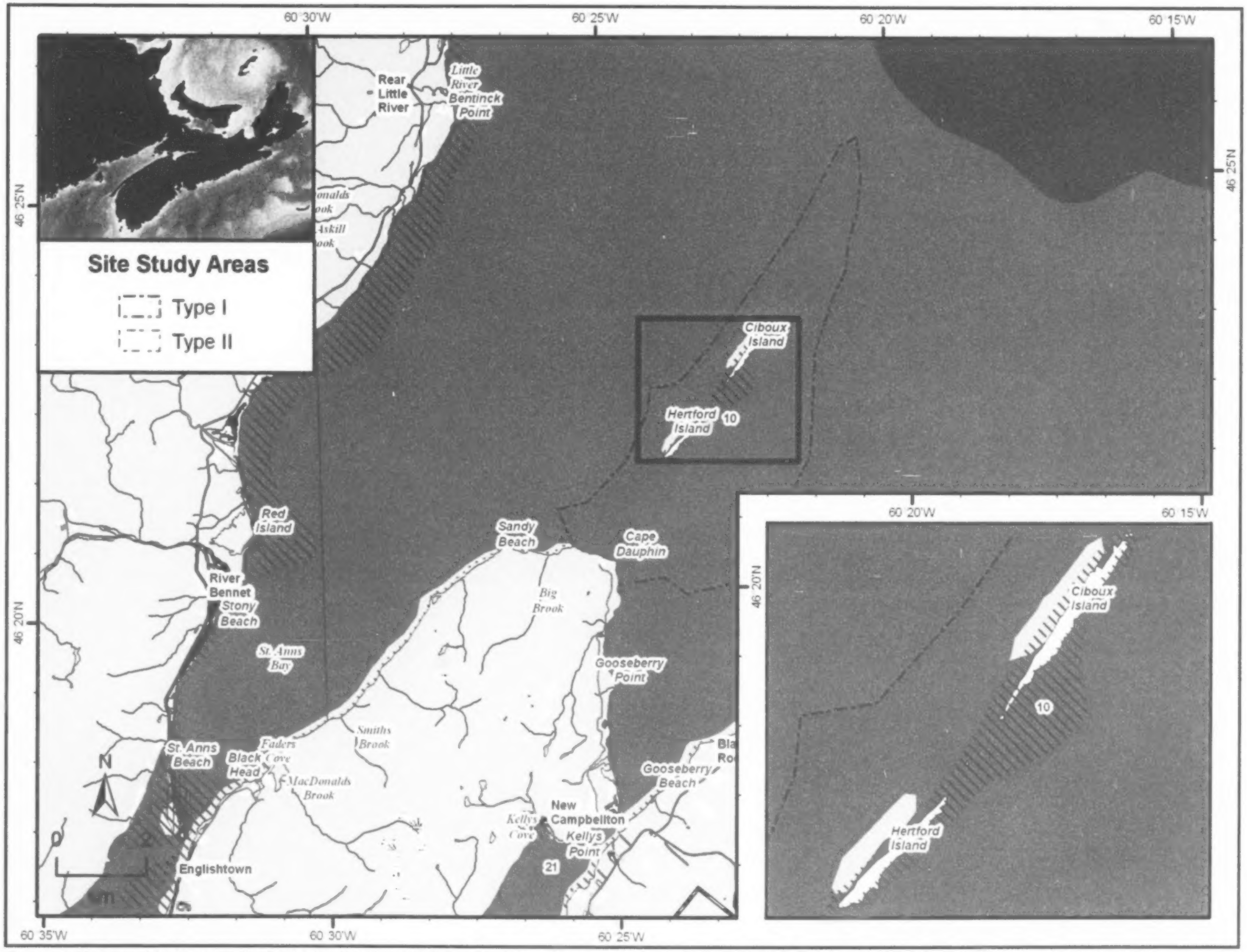
Figure 4.37 Coastal Habitats on the Bird Islands (Site =10). Basemap layers: land 1:50 000, 1:250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); NSDNR Wetlands Database layers (NSDNR 2000). Refer to Figure 4.2 for legend.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Little River
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Red Island
River Bennet
Stony Beach
St. Anns Bay
St. Anns Beach
Black Head
Faders Cove
MacDonalds Brook
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Ciboux Island
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Figure 4.37 Coastal Habitats on the Bird Islands (Site #10). Basemap layers: land 1:50 000, 1:250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); NSDNR Wetlands Database layers (NSDNR 2000). Refer to Figure 4.2 for legend.

Ecological Attributes

The Bird Islands were identified by scientific experts as an EBSA. The islands meet the three primary EBSA criteria of uniqueness, aggregation, and fitness consequences to a high degree and the secondary criteria of naturalness and resilience to a medium degree (Doherty and Horsman 2007). The Bird Islands were one of four areas identified five times by scientific experts in the EBSA identification process whereas many other areas were only identified once or twice (Doherty and Horsman 2007). They were also identified as one of ten Significant Habitats in the Sydney Bight area by Schaefer *et al.* (2004). It is the only Significant Area with a detailed description in this document, which could indicate that it is of greater importance than the other areas identified or that more information is available for the islands.

The Bird Islands are primarily recognized for their importance for diverse assemblages of birds which breed and nest on the island. They support the largest Great Cormorant Colony in North America, hosting 10% of the North American population and 1% of the global population (Dietz and Chiasson 2000; Schaefer *et al.* 2004; BSC 2002).

The area is important for commercial and non-commercial fish species. The offshore area, just outside the study area, serves as a spawning area for the 4Vn cod stock, herring, and capelin (Schaefer *et al.* 2004; Bundy *et al.* 2007). The immediate area is an important nursery area in Sydney Bight for Atlantic cod among other groundfish species (Lambert and Wilson 2006 *In* DFO 2006a) such as American plaice, yellowtail flounder and winter flounder (T. Lambert, DFO Science Branch, pers. comm. 2002 *In* Schaefer *et al*. 2004). The area is a herring overwintering area for the Bras d'Or Lakes stock and is a seal haul-out area (Schaefer *et al.* 2004). The mainland salmon population is one of the healthiest and largest in the area (Gibson *et al.* 2006). Lobster bottom and scallop beds surround the islands and the area has a high abundance of lobster. The waters surrounding the Bird Islands may be an overwintering area for lobster (T. Lambert, DFO Science Branch, pers. comm. 2010).

The area is home to two COSEWIC-assessed species: Atlantic cod and winter skate (Bundy *et al.* 2007). The surrounding area is noted to have concentrations of whales including the fin whale (special concern, SARA) (Doherty and Horsman 2007). The Great Bras d'Or Channel serves as an important migration route for at least ten fish species which likely pass through the Bird Islands (Tupper 1997 *In* Schaefer *et al.* 2004).

The islands are highly productive with extensive kelp beds providing primary productivity (VCCRMP 1997) and numerous species of fish and invertebrates contributing to secondary productivity.

There are few coastal islands in Sydney Bight; the Bird Islands area is therefore unique on a sub-regional scale. They serve as representative examples of coastal islands with cliff environments ideal for nesting birds (Schaefer *et al.* 2004). Although naturalness would be assumed as high as they are uninhabited and far enough from mainland to be unimpacted by coastal development (Schaefer *et al.* 2004; BSC 2002), they were determined to have a medium naturalness in the 2006 EBSA workshop (Doherty and Horsman 2007).

Bird Information

This area corresponds to the Bird Islands IBA (Number NS001) and is of greatest importance to birds during the summer breeding season. In particular, the Great Cormorant colony located here is the largest in North America and counts of this species are of global significance (BLI 2009). Although not in nationally significant numbers, other seabird species also nest on the Bird Islands. Among the latter are the highest concentrations of Black-legged Kittiwake, Razorbill and Atlantic Puffin in Nova Scotia. Leach's Storm-petrel, Double-crested Cormorant, and Black Guillemot, also breed on the Islands. Geese, dabbling ducks, and bay ducks are not known to frequent this site, while sea ducks can be found here in high numbers.

Important Marine Ecological Features:

- Atlantic cod, capelin and herring spawning ground in surrounding waters
- Important nursery area for Atlantic cod and other groundfish species
- Herring overwintering area for Bras d'Or Lake stock
- Seal haul-out area
- COSEWIC-assessed species: Atlantic cod (endangered) and winter skate (threatened)
- The only islands along important migration route to the Bras d'Or Lakes
- Extensive kelp beds
- Birds: IBA(1), colonies

Human Uses

Schaefer *et al.* 2004 list human uses and potential impacts to the area including human disturbance, fishing, oil and gas exploration (seismic), and potential oil pollution (from spills related to shipping or oil and gas development).

Coastal Development

The Bird Islands themselves are undeveloped and the adjacent mainland has very low levels of residential development, however, there are industrial developments on the mainland. The mainland lacks a municipal planning strategy and land use bylaws (see Appendix D) (CBCL Limited 2009).

The islands have not had mining activities, but there are active mines in the nearby watershed for limestone along the Great Bras d'Or Channel. There is an active limestone mine in Kellys Cove on the mainland near the Bird Islands that will produce 773 tonnes of dolometic limestone (NSDNR 2006a). The mine employs two people (*Ibid.*). There were two active coal mines at Point Aconi in 2000 but they do not appear to currently be active (Fisher and Wenning 2008). There is a mineral closure in most of the offshore and in the rest of this area (Schaefer *et al.* 2004).

The Point Aconi power station discharges cooling water (Schaefer *et al.* 2004), arsenic, cadmium, copper, lead, manganese, nickel, vanadium, and zinc into the Sydney Bight area, as reported in the NPRI (Environment Canada 2008b). Although Point Aconi is downstream of the Bird Islands, variability in circulation may result in impacts to the Bird Islands. These developments have likely caused an increase in shipping traffic and other potential impacts, such as pollution.

The area may have potential for wind energy development, with high wind speeds of 8.01-9.5 m/s on the islands and adjacent mainland (Province of Nova Scotia 2010).

Commercial Fishing

Rock crab, scallops, and lobster are the primary fisheries near the Bird Islands (VDC 2009; DFO 2005a). Rock crab landings are high on a provincial scale and scallop landings are not, but do make up 29% of total landings in the area (excluding lobster) (VDC 2009). Groundfish had very low landings in the area from 1999-2003 which were caught toward the edge of the study area (DFO 2005a). Herring and mackerel were not landed in the area in 2007-2009 (VDC 2009) and previous landings were low (DFO 2005a).

Lobster catch and effort information is not available on a fine enough scale to determine landings in the immediate area, but Sydney Bight is a relatively important lobster fishing area in Cape Breton, and of intermediate importance on a regional scale. Landings around the Bird Islands are low to medium relative to other sites and overall landings in DFO's Maritimes Region. In grid squares 355 and 356, the reporting units that most closely align with the study area, 2008 lobster landings are estimated at 311 MT. These landings comprise 1.05% of 2008 landings in the Maritimes Region and 11.54% of LFA 27 landings in 2008. LFA 27 comprises 9.06% of 2008 landings in the Maritimes Region (VDC 2009).

There are two Small Craft Harbours in the nearby area (Point Aconi and Alder Point) and there is one government wharf in St. Anns Harbour. There are numerous wharves in other areas nearby but are closer to other study areas such as Western Sydney Bight (CCN 2006). Fishing is mainly conducted out of Big Bras d'Or and Kelley Cove at the opening to the Great Bras d'Or Channel leading to the Bras d'Or Lakes (T. Lambert, DFO Science Branch, pers. comm. 2010).

Table 4.19 below provides a summary of commercial fisheries within the Bird Islands study area.

Table 4.19 Summary of Major Commercial Fisheries and Gear Used in and Adjacent to the Bird Islands Study Area

Species	Landings*	Gear	Year	Source
Groundfish: flatfish, some halibut	L	Bottom longline	1999-2003	DFO 2005a
Rock crab	M-H	Pot	2007-2009	VDC 2009
Scallop	L	Dredge	1999-2003 2007-2009	DFO 2005a VDC 2009
Lobster	L-M	Pot	2008	VDC 2009
Herring	L	N/A	1999-2003	DFO 2005a
Mackerel	L	N/A	1999-2003	DFO 2005a

*H = high, M = medium, L = low

Oil and Gas

The Hunt Oil Company of Canada Ltd. was issued license no. EL 2364 for oil and gas exploration and development. This license comprises a large portion of Western Sydney Bight and includes the Bird Islands (DFO 2001a). The impacts of oil and gas exploration in this area would be "amplified due to the small, shallow, enclosed nature of the environment and the high biomass and diversity year-round" (*Ibid.*). Seismic surveys were conducted in a large area approximately 25 km north of the Bird Islands in 2005, during a period which was determined to have the lowest impact on migrating species (Hunt Oil Company of Canada Inc. 2005). There are no current petroleum interests in the area (Nova Scotia Energy 2009), however there is potential for further development.

Tourism, Recreation, and Culture

Due to the remote nature of the Bird Islands there are few recreation activities, but there are some ecotourist operators that travel to the islands. At least two companies give boat tours of the islands, but there are a total of eleven whale and bird watching boat tour companies in nearby communities that likely visit the islands. The main attraction is the puffins (Schaefer *et al.* 2004).

The closest harbours are Little River, Jersey Cove, English Cove, Big Bras d'Or, Point Aconi, Kelley Cove and Alder Point. Tourism operators are based in Englishtown (Donelda's Puffin Boat Tours), Big Bras d'Or (Bird Island Boat Tours) and others in Bay St. Lawrence and Aspy Bay (Schaefer *et al.* 2004) which likely visit the islands.

There are concerns that increasing ecotourism and increased access to the islands will negatively impact the bird colonies and their habitat (Dietz and Chiasson 2000).

Current Protection and Research/Conservation Initiatives

The Bird Islands were designated as a Wildlife Management Area in 2009 (NSDNR 2009a). The islands are of interest to conservation organizations such as the Nova Scotia Bird Society (NSBS) who owns Hertford Island, a NSBS Sanctuary. Both islands are a designated IBA. Prior to the WMA designation, there were concerns that Ciboux Island was vulnerable to disturbance due to access by small boats and ecotourism operations (BSC 2009). Two tour operators in the area have made efforts to spread awareness of the impacts to the islands (*Ibid.*).

Sydney Bight, including the Bird Islands, was recognized as a preliminary ecological priority area in the Scotian-Shelf Bay of Fundy region (DFO 2009b) in DFO's preliminary offshore MPA network planning. A larger site comprising all of Sydney Bight was assessed using the methodology applied in the offshore (MARXAN analysis) (*Ibid.*) and this smaller area of Western Sydney Bight is being assessed as part of this initiative for coastal conservation planning.

Although there are no current research initiatives specific to the Bird Islands, there is trawl survey data available for the area which was used to identify Sydney Bight (including the Bird Islands) as a preliminary ecological priority area in the MARXAN analysis.

Summary

Table 4.20 below summarizes the key information provided in the site profile. The Bird Islands are known for their ecological importance both on land and in surrounding waters. The area is unique on a sub-regional scale as they are the only islands in Western Sydney Bight along the migration route for many species that travel between Sydney Bight and the Bras d'Or Lakes. The ecological attributes align with all of the *Oceans Act* criteria for MPA establishment.

Table 4.20 Summary of the Bird Islands Site Profile

***Oceans Act* Criteria (s.35)**	**Ecological Attributes**	**Human Uses**	**Current Protection and Research Initiatives**
(a) The conservation and protection of commercial and non-commercial fishery resources, including marine mammals, and their habitats; (b) The conservation and protection of endangered or threatened marine species, and their habitats (c) The conservation and protection of unique habitats; (d) The conservation and protection of marine areas of high biodiversity or biological productivity	• Atlantic cod, capelin, and herring spawning ground in surrounding waters • Important nursery area for Atlantic cod and other groundfish species • Herring over-wintering area for the Bras d'Or Lake stock • Seal haul-out area • The only islands along important migration route to the Bras d'Or Lakes • COSEWIC species: Atlantic cod and winter skate • Extensive kelp beds • Birds: IBA (1), colonies	• Fishing - lobster - groundfish (flatfish and some halibut) - scallop - rock crab • Tourism: bird and whale watching • Potential for oil and gas activities in the offshore area • Mainland industrial uses (mines, power station)	• Recently designated a provincial WMA • No current research initiatives, but area was identified as a preliminary ecological priority area for the offshore Scotian Shelf

4.11 St. Paul Island

St. Paul Island is a very remote, uninhabited island found approximately 24 km from mainland Nova Scotia and is known as the "the Graveyard of the Gulf" for its very treacherous conditions. The area has over 350 shipwrecks as a result. There are several breeding bird colonies and the area is significant for Atlantic cod. Other species aggregate near the island, but little is known about the ecology of the marine environment immediately surrounding the island.

Location and Population

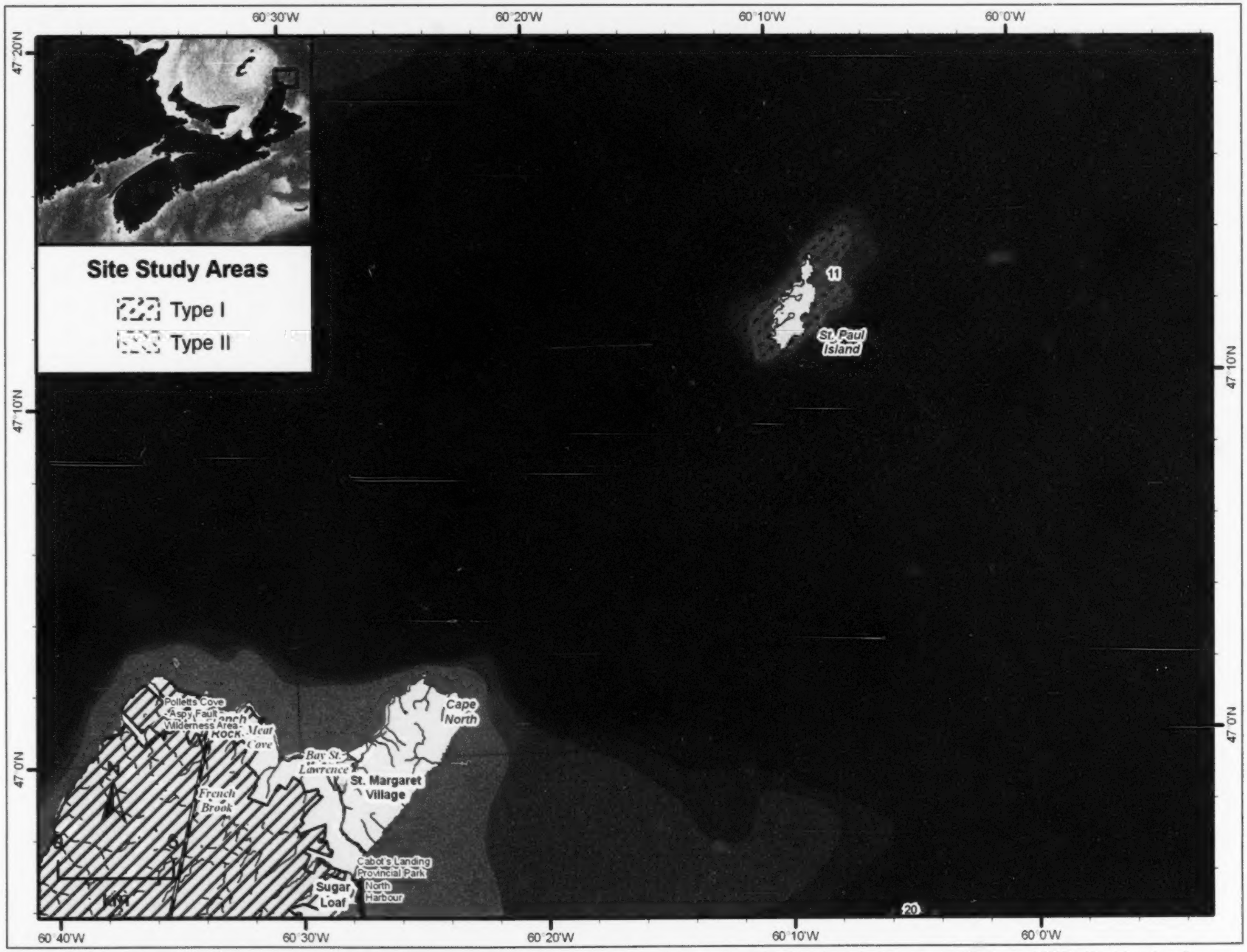
St. Paul Island is at the edge of the northward portion of the study area in this analysis, and is located approximately 24 km northeast of Cape North which is the northernmost tip of Cape Breton Island. The island borders the Gulf of St. Lawrence and the Cabot Strait and is located in Victoria County. The island is uninhabited but has two solar powered lighthouses, with one located on a smaller rock island separated from the larger island on the northeast. The study area is approximately 322.6 km^2 and comprises the waters surrounding the island. See Figure 4.38 for a location map of St. Paul Island. The closest town is Bay St. Lawrence, which is a small fishing community. The area has a very low average population density of 0-10 people per km^2 (Municipal Services 2001).

Physical and Oceanographic Attributes

St. Paul Island is the farthest area from the mainland in this analysis and is the northernmost area of Nova Scotia. The island itself is approximately 4.8 km long and 1.6 km wide and has a very rugged granite terrain (Traver 2006). It is an extension of the Appalachian Mountains and the Cape Breton Highlands and has a coastline of steep rock faces and is covered by stunted spruce fir trees. The island is indented and has two inland lakes (*Ibid.*). The highest point on the Island is called Crogan Mountain and is 147 m high (*Ibid.*).

St. Paul Island is remote and experiences rough weather (Traver 2006). The area is dominated by strong currents and has a large fetch which enables winds from the northwest to generate large waves (B. Petrie, DFO Science Branch, pers. comm. 2009). Powerful currents often wreak havoc on longline fishing and trawling operations attempted in this area. Longline trawl often becomes hopelessly tangled and a trawl net can tangle and become inoperable when attempting to tow across a current (T. Lambert, DFO Science Branch, pers. comm. 2010).

Sea ice created elsewhere is carried by currents to the St. Paul Island area (Traver 2006). There are also rocky reefs surrounding the island which make navigation difficult (Traver 2006). The area has a low to moderate sensitivity to sea level rise (NRCan 2007). The island lacks sensitive coastal features, however there are narrow marine flats surrounding the island, as illustrated in Figure 4.39. The maximum depth of the study area is 549 m, which is in the Laurentian Channel (CHS Chart 4022).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Site Study Areas
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Cape North
Polletts Cove - Aspy Fault Wilderness Area
Meat Cove
Bay St. Lawrence
St. Margaret Village
French Brook
Cabot's Landing Provincial Park
North Harbour
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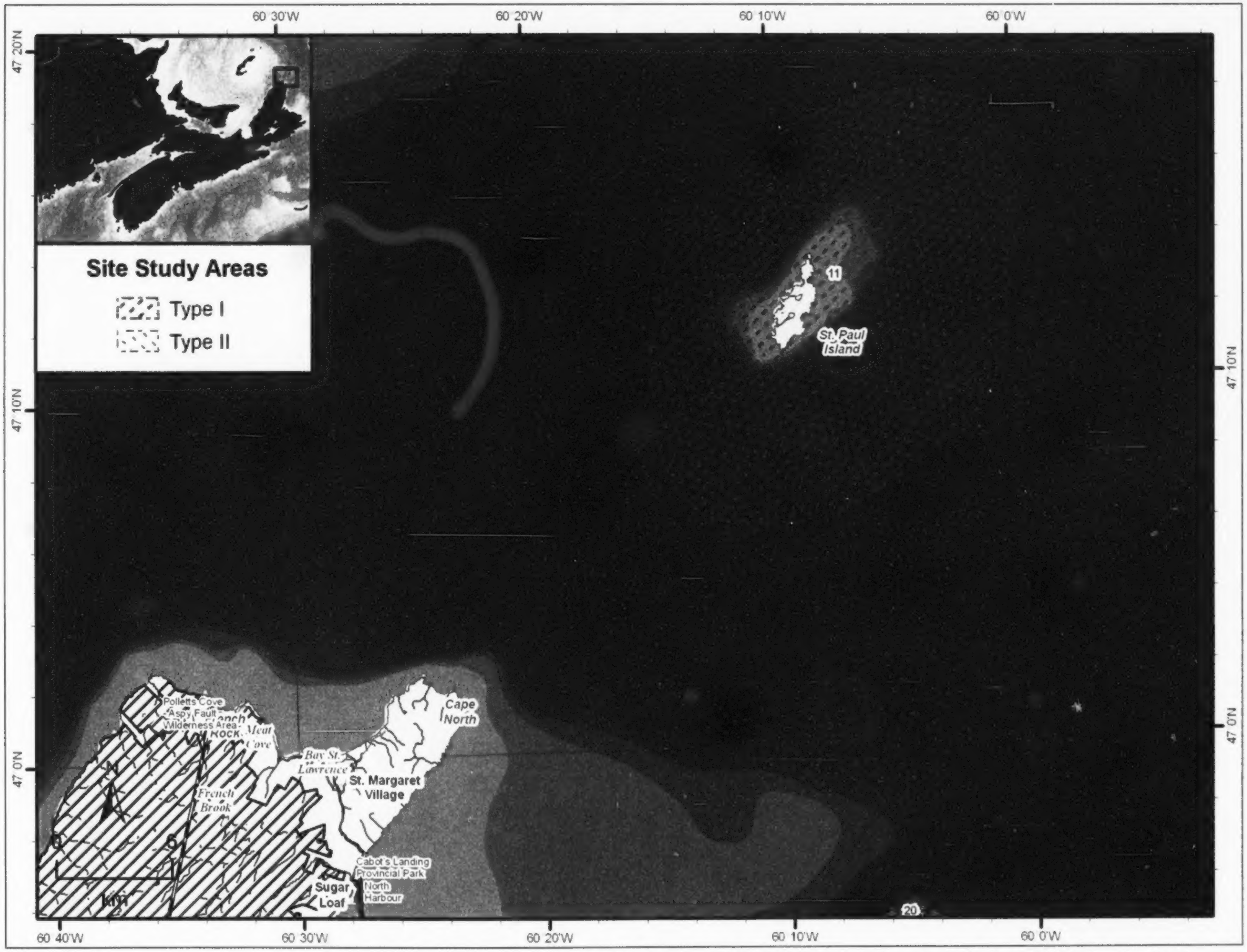
Figure 4.38 Location Map for St. Paul Island (Site #11). Basemap layers: land 1: 50 000, 1: 250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); Restricted and Limited Use Land Database Layers (NSDNR 2006b). Refer to Figure 4.1 for legend.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Bay St. Lawrence
St. Margaret Village
French Brook
Cabot's Landing Provincial Park
North Harbour
Sugar Loaf
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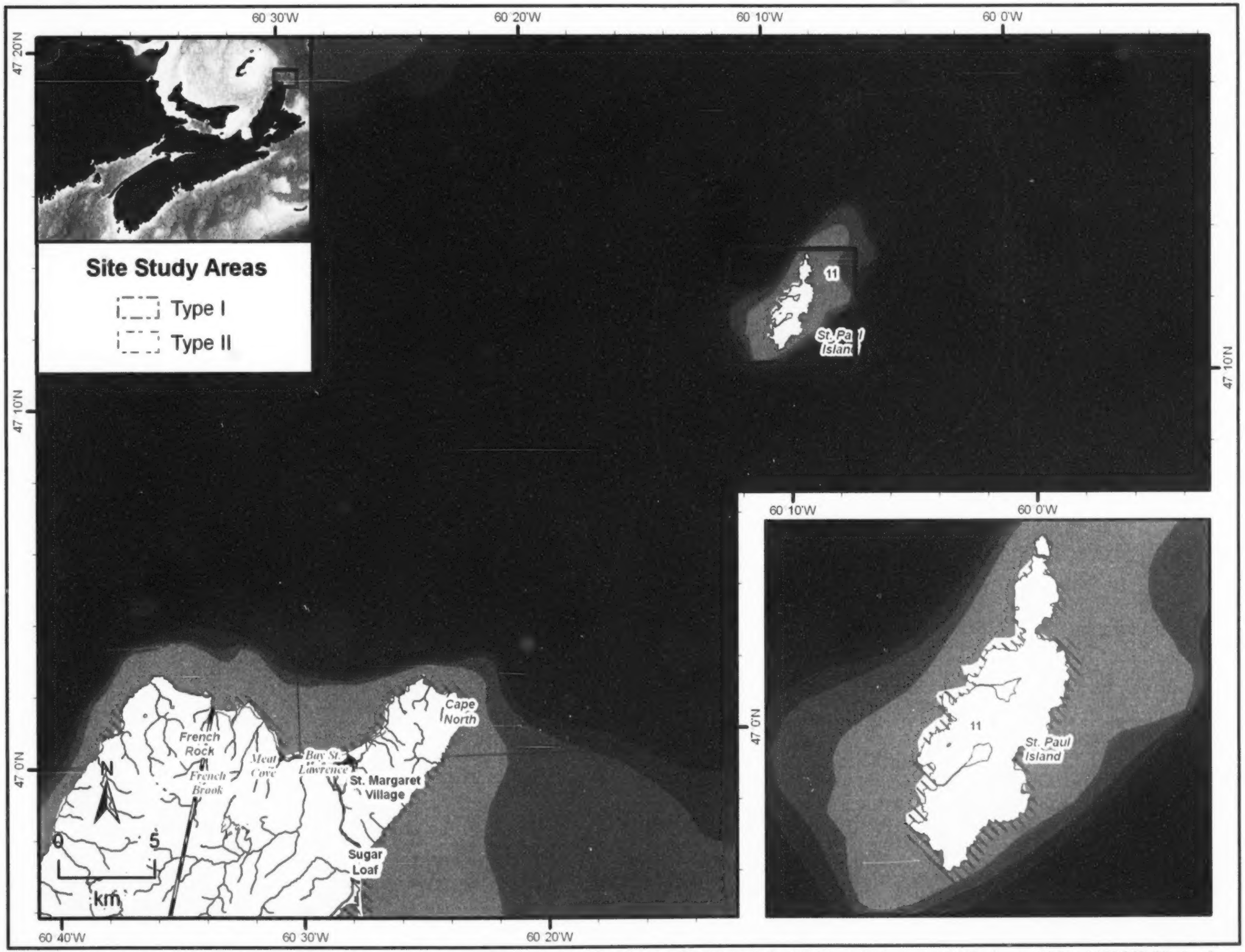
Figure 4.38 Location Map for St. Paul Island (Site #11). Basemap layers: land 1: 50 000, 1: 250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); Restricted and Limited Use Land Database Layers (NSDNR 2006b). Refer to Figure 4.1 for legend.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French Brook
Meat Cove
Bay St. Lawrence
St. Margaret Village
Sugar Loaf
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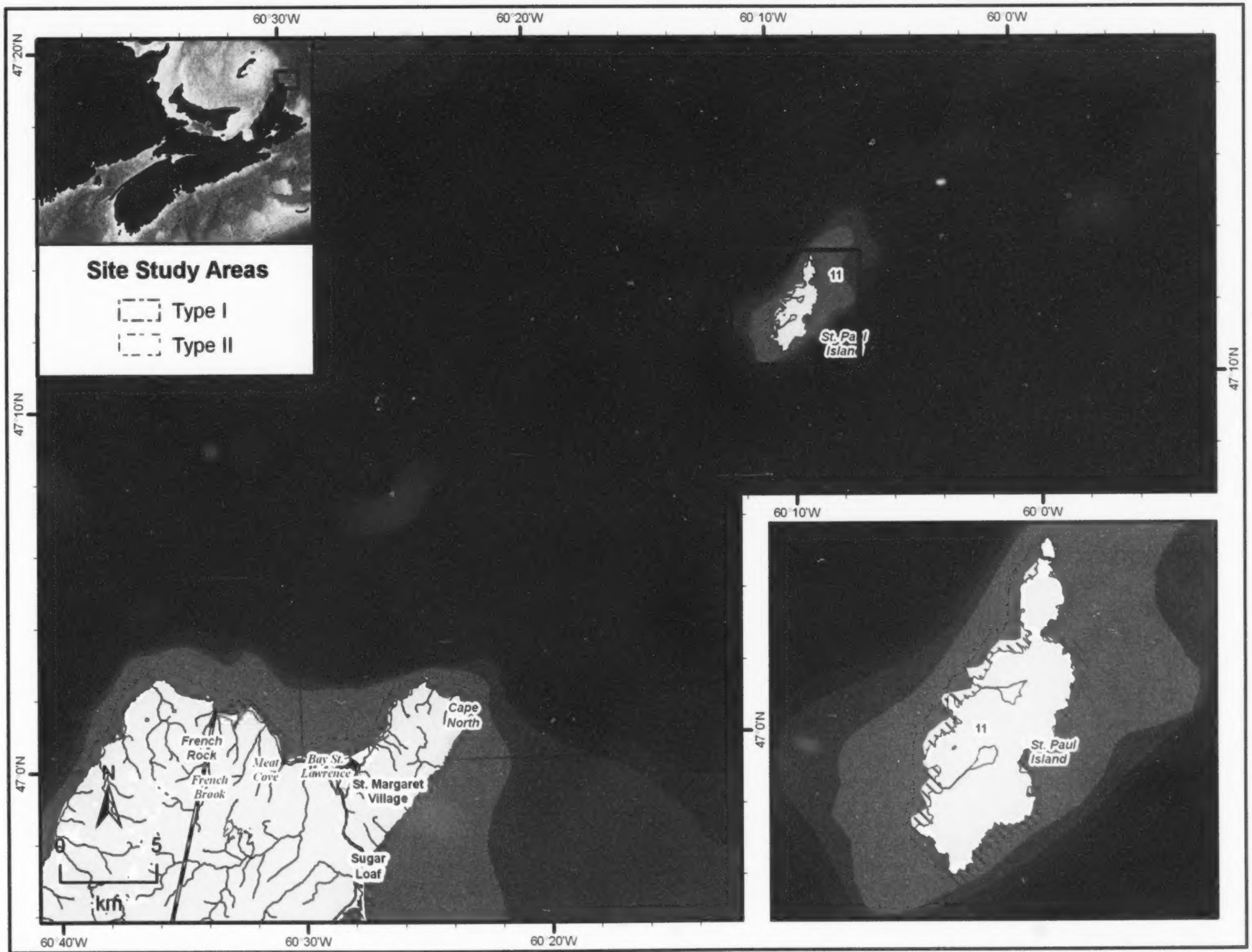
Figure 4.39 Coastal Habitats on St. Paul Island (Site #11). Basemap layers: land 1:50 000, 1:250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); NSDNR Wetlands Database layers (NSDNR 2000). Refer to Figure 4.2 for legend.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St. Paul Island
French Rock
French Brook
Meat Cove
Bay St. Lawrence
St. Margaret Village
Cape North
Sugar Loaf
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Figure 4.39 Coastal Habitats on St. Paul Island (Site #11). Basemap layers: land 1:50 000, 1:250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); NSDNR Wetlands Database layers (NSDNR 2000). Refer to Figure 4.2 for legend.

Ecological Attributes

St. Paul Island was identified by scientific experts as an EBSA. It meets the three primary EBSA criteria, uniqueness, aggregations, and fitness consequences. It was one of four areas identified five times by scientific experts in the EBSA identification process whereas many other areas were only identified once or twice (Doherty and Horsman 2007).

The area is likely important for marine species, although there is little information on the marine environment relative to other sites in this report. There are few islands in eastern Cape Breton (Doherty and Horsman 2007) and it may be important for life cycle stages during migrations between the Atlantic Ocean and the Gulf of St. Lawrence.

According to the Highland Coastal Mapping Association (2001) the St. Paul Island area was a herring spawning area, however, it was not identified as a herring spawning area in the 2009 Assessment of 4VWX herring (DFO 2009d). St. Paul Island is a distinct overwintering and spawning area for Atlantic cod where two populations mix (Campana *et al.* 1999). Atlantic wolffish (special concern, SARA) can also be found in the area (King 2004). Satellite tracking data indicate that the area surrounding St. Paul Island constitutes seasonal high-use habitat for the endangered (SARA) leatherback turtle (James et al. 2005).

There are general reports of cetacean concentrations in the surrounding area; sperm whales (possibly year-round), baleen whales, pilots whales, and dolphins (Doherty and Horsman 2007).

The area may be unique for lobster which aggregate around the island (Doherty and Horsman 2007). Other aggregating species include snow crab, toad crab, scallops, redfish (Highland Coastal Mapping Association 2001; McClintock 2001), and mackerel which migrate through the area to the Gulf of St. Lawrence in summer months (T. Lambert, DFO Science Branch, pers. comm. 2010).

The area did not meet the EBSA criteria for naturalness in the 2006 EBSA workshop (Doherty and Horsman 2007). Naturalness is likely medium to high. Although the island is remote and there are no land-based impacts, naturalness may be impacted by fishing activity and high shipping traffic through the area.

Bird Information

St. Paul Island is potentially an important area for some colonial bird species, although systematic breeding bird surveys have not been conducted there (CWS). It may for example support important numbers of Leach's Storm-petrel (Doherty and Horsman 2007) as well as other seabird species (Traver 2006). Nonetheless, the island is known to host a modest number of breeding Great Black-backed Gulls. This area largely coincides with the St. Paul Island IBA (Number NS032), designated as such because it is likely an important nesting area for the terrestrial Bicknell's Thrush (special concern, SARA; CWS), thought to be found here in nationally significant numbers (CWS). Systematic waterfowl and shorebird surveys have not occurred at this site, precluding comment on goose, bay duck, sea duck, dabbling duck, and shorebird use of the area.

Important Marine Ecological Features:

- Significant spawning and overwintering area for Atlantic cod; mixing of several populations
- Cetacean concentrations in surrounding area: sperm whale likely year-round resident, likely cetacean feeding area
- Other aggregations: lobster, snow crab, toad crab, scallops, urchins, and mackerel
- Likely important for lifecycle stages during migrations between Atlantic Ocean and Gulf of St. Lawrence
- SARA-listed species: leatherback turtle (endangered), Atlantic wolffish (special concern) and Bicknell's Thrush (special concern)
- COSEWIC-assessed species: Atlantic cod (endangered)
- Birds: IBA(1), species at risk (terrestrial bird species)

Human Uses

Due to the remoteness of the island, there are few human uses on and around St. Paul Island. Human uses area limited to fishing, shipping, and occasional recreational SCUBA diving.

Coastal Development

St. Paul Island has very little development with a few abandoned buildings and a lighthouse. The adjacent mainland has very low levels of residential development. The mainland lacks a municipal planning strategy and land use bylaws (see Appendix D) (CBCL Limited 2009).

Commercial Fishing

The primary fisheries in the area from 2007-2009 were redfish, halibut including Greenland halibut, white hake, and Atlantic cod, all of which are not immediately adjacent to the island but are within or adjacent to the study area (VDC 2009). Atlantic cod and white hake are not targeted species in this area and are caught as by-catch in other fisheries. St. Paul Island is the only area in this analysis with significant groundfish trawling (DFO 2005a; VDC 2009). Fisheries in 1999-2003 reflect recent data, but also included snow crab landings and shark landings, both of which were very low but within the immediate study area (DFO 2005a).

Lobster landings in this area are negligible. Grid square 362, the reporting unit that most closely aligns with the study area, does not have any recorded lobster landings for 2008. This could be due to low reporting levels within the grid square (VDC 2009). However in the 2006 EBSA identification workshop for the Scotian Shelf (see page 10) it is stated: "there is a good, consistent, and stable lobster fishery around the island" (Doherty and Horsman 2007). Due to uncertainty of the data, landings in this area are recorded as low.

The closest communities with public wharves are Bay Saint Lawrence, Dingwall, Meat Cove, New Haven, Ingonish, and Neil's Harbour, with several others south of Neil's Harbour. There is also a community fishing wharf at Smelt Brook. There are two processing plants in the area (CCN 2006). Table 4.21 below provides a summary of commercial fisheries within the St. Paul Island study area.

Table 4.21 Summary of Major Commercial Fisheries and Gear Used in and Adjacent to the St. Paul Island Study Area

Species	Landings*	Gear	Year	Source
Redfish	H	Otter trawl	1999-2003 2007-2009	DFO 2005a VDC 2009
Halibut (including some Greenland halibut)	M	Longline	1999-2003 2007-2009	DFO 2005a VDC 2009
Atlantic cod	L	Longline	1999-2003 2007-2009	DFO 2005a VDC 2009
White hake	L	Danish seine	2007-2009	VDC 2009
Lobster	L	Trap	2008	VDC 2009
Snow crab	L	Trap	1999-2003	DFO 2005a
Porbeagle, mako, blue shark	L	Longline	1999-2003	DFO 2005a

*H = high, M = medium, L = low

Shipping

St. Paul Island is between two vessel traffic service zones and is south of an area where three major shipping lanes merge (DFO 2005a). Shipping may affect the cetaceans and the overall ecosystem through species introductions, pollution, and potential collisions.

Tourism, Recreation, and Culture

St. Paul Island once had a lighthouse keeper living full time on the island. The few buildings remaining on the island have been abandoned for over 40 years. They are beginning to disintegrate and no one is permitted to approach within 30 m of any of the structures (Traver 2006). Access to the island itself is likely very minimal, however; the island is a popular destination for diving as there are numerous opportunities to explore shipwrecks. Due to the persistent rough weather and shallow water, there are over 350 shipwrecks in the "Graveyard of the Gulf" (Clancy 2004).

The nearby mainland has a few tourist operators and accommodations in nearby towns such as Dingwall and Neils Harbour. Ecotourism operators bring SCUBA diving and snorkelling tours and provide boat tours to the Island (St. Paul Island Trading Company, Dingwall). The area is significant for whale and bird watching and there are five whale watching businesses in Pleasant Bay (CCN 2006).

Current Protection and Research/Conservation Initiatives

There is currently no legal protection of St. Paul Island, although it is an IBA (BSC 2009).

There is a lack of current information of the marine environment of St. Paul Island, likely due to its remote nature, although some trawl survey data are available.

Summary

Table 4.22 below summarizes the key information provided in the site profile. Although there is not a lot of marine information on St. Paul Island, particularly regarding marine plant and species distribution, the area appears to be ecologically significant and meets all of the *Oceans Act* criteria for MPA establishment.

Table 4.22 Summary of the St. Paul Island Site Profile

Oceans Act Criteria (s.35)	Ecological Attributes	Human Uses	Current Protection and Research Initiatives
(a) The conservation and protection of commercial and non-commercial fishery resources, including marine mammals, and their habitats; (b) The conservation and protection of endangered or threatened marine species, and their habitats (c) The conservation and protection of unique habitats; (d) The conservation and protection of marine areas of high biodiversity or biological productivity	• Significant spawning and overwintering area for Atlantic cod; mixing of several populations • Cetacean concentrations in surrounding area: sperm whale likely year-round resident, likely cetacean feeding area • Other aggregations: lobster, snow crab, toad crab, scallops, urchins, and mackerel • Likely area for important lifecycle stages during migration between Atlantic Ocean and Gulf of St. Lawrence • SARA species: leatherback turtle, Atlantic wolffish, and Bicknell's Thrush (terrestrial) • COSEWIC species: Atlantic cod • Birds: IBA(1)	• Fishing - redfish - halibut - cod - white hake - lobster - snow crab • Shipping • Occasional SCUBA diving	• No legal protection • No current research or conservation initiatives

4.12 The Bras d'Or Lakes

The limited exchange between the Bras d'Or Lakes and the waters of the Scotian Shelf combine with other physical and biological features, making the Lakes a unique ecosystem. The Lakes play a central role in the culture of the First Nations inhabiting their shores and the Mi'kmaq have contributed greatly to our understanding of the Lakes by the sharing of their traditional ecological knowledge (TEK) and through cooperative research programs with universities and government science agencies. The ecosystem degradation, particularly in more populous regions, is widely recognized and management efforts are underway to address this issue.

Location and Population

The Bras d'Or Lakes are large inland brackish lakes located in the centre of Cape Breton Island spanning all four counties on the Island: Inverness, Victoria, Cape Breton, and Richmond, with a total marine area of 1071.5 km^2. The total population of the Bras d'Or Lakes watershed is approximately 22,000 people spread out among many small communities. The overall population density is considered low, with 0-10 people/km^2 in most areas but two small areas have urban densities of over 140 people per km^2 (Municipal Services 2001). The East Bay watershed is the most populated. The towns in the area (with the population in parentheses) include: Bras d'Or (2,856), Eskasoni (2,740), and Baddeck (2,377) (Parker *et al.* 2007). There are several First Nation Reserves located around the Lakes: the Eskasoni, Wagmatcook, Whycocomagh, Malagawatch, and Chapel Island. See Figure 4.40 for a location map of the Bras d'Or Lakes.

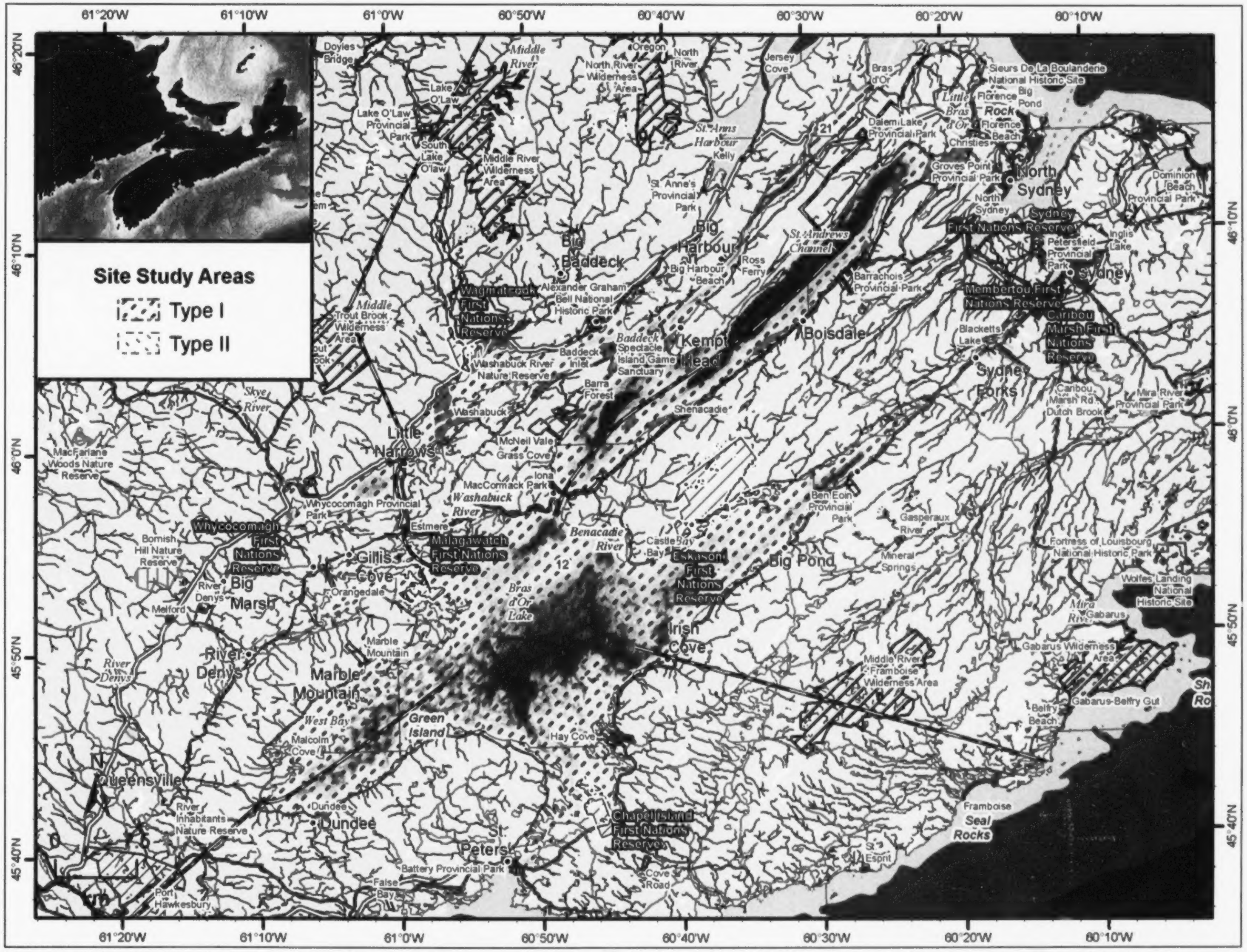
Physical and Oceanographic Attributes

The Bras d'Or Lakes are the largest estuarine environment in the province and have a salinity range of 20-25 parts per thousand (ppt) averaging 22 ppt (Petrie and Bugden 2002) which is much lower than the average salinity for seawater at 35 ppt. The Lakes have small tidal ranges and a long flushing time creating limited mixing (*Ibid.*). The Lakes are composed of five main channels and several bays and basins, many of which are separated by sills. The average depth of the Lakes is approximately 30 m with a maximum depth of 280 m in St. Andrew's Channel (Strain and Yeats 2002). The Bras d'Or Lakes are a brackish fjordal system with a series of channels and embayments connected to the Atlantic at three locations (Petrie and Bugden 2002). To the north, the Great Bras d'Or Channel leading to Sydney Bight allows the bulk of the exchange of ocean and lake water (*Ibid.*). The much smaller Little Bras d'Or Channel, also connecting to Sydney Bight, permits a much smaller transport of water between the two bodies of water (*Ibid.*). In the south, St. Peter's Canal gives access to Chedabucto Bay. At this location small amounts of water are exchanged intermittently with the transit of boats through the locks (*Ibid.*). The small amount of tidal exchange created the unique oceanographic conditions seen nowhere else in Atlantic Canada. The limited tidal exchange results in very slow flushing times of up to two years (*Ibid.*).

Parker *et al.* (2007) describe additional physical and oceanographic attributes of the Bras d'Or Lakes. The marine portion of the Lakes is approximately 1086 km^2 with a coastline length of approximately 1000 km including hundreds of small coves, bays, and inlets. The Lakes have a total watershed area of 3565 km^2 which includes 12 sub-watersheds (see Appendix E), the terrestrial and freshwater portion make up 2479 km^2 of the watershed. The six major rivers which flow into the Lakes account for the majority of freshwater input (42%): Denys, Benacadie, Baddeck, Middle, Skye, and Washabuck Rivers. The surrounding landscape of the Bras d'Or Lakes varies in relief from highlands to lowlands. There are 12 terrestrial habitat types which are used by a variety of birds and mammals (Parker *et al.*

2007). There are drumlin and moraine formations which make up some of the islands and seabed features (Davis and Browne 1996b). The Lakes have a low to high sensitivity to sea level rise; the area predominately has a low sensitivity but is highly sensitive in the southeast (NRCan 2007).

Typical of most estuarine environments, the Bras d'Or Lakes contain a diversity of habitats including marine and estuarine flats, productive salt marshes and eelgrass beds, and coastal saline ponds (Parker *et al.* 2007). Some of these features are illustrated in Figure 4.41. Due to the low tidal amplitude of the Lakes, the intertidal zone is very narrow and does not support numerous or extensive intertidal habitats. The benthic habitat is mainly composed of mud and sand sediment with few rocky shores (Parker *et al.* 2007; Tremblay *et al.* 2005).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46°20'N
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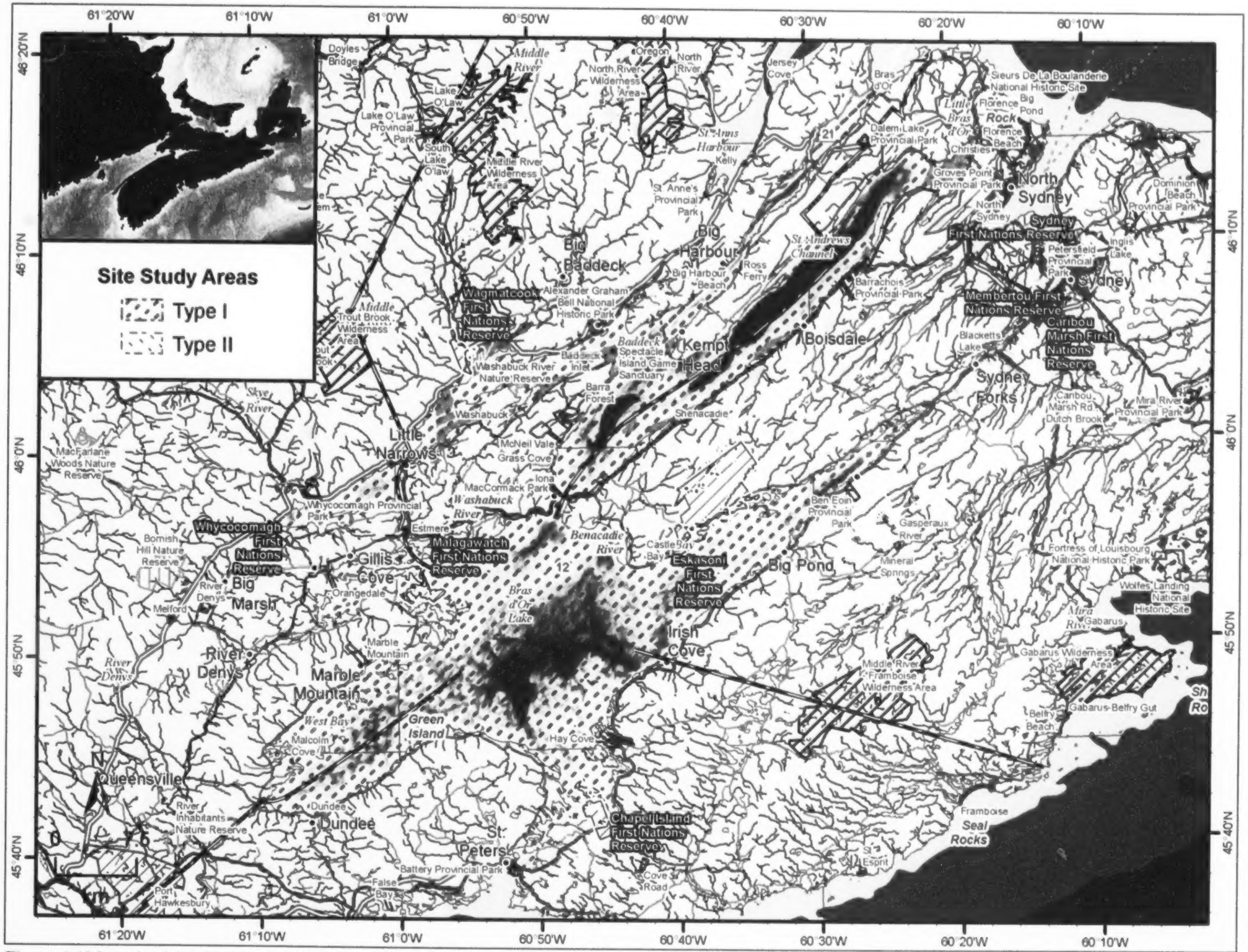
46°0'N
45°50'N
45°40'N
Site Study Areas
Type I
Type II
Doyles Bridge
Middle River
Lake O'Law
Lake O'Law Provincial Park
South Lake O'law
Middle River Wilderness Area
North River Wilderness Area
Oregon
North River
St. Anns Harbour
Kelly
St. Anne's Provincial Park
Jersey Cove
Bras d'Or
Little Bras d'Or
Dalem Lake Provincial Park
Sieurs De La Boularderie National Historic Site
Florence
Big Pond
Rock
Florence Beach
Christies
Groves Point Provincial Park
North Sydney
Dominion Beach Provincial Park
Sydney First Nations Reserve
Petersfield Provincial Park
Inglis Lake
Sydney
Big Baddeck
Big Harbour
Big Harbour Beach
Ross Ferry
St. Andrews Channel
Barrachois Provincial Park
Membertou First Nations Reserve
Caribou Marsh First Nations Reserve
Blacketts Lake
Sydney Forks
Caribou Marsh Rd
Dutch Brook
Mira River Provincial Park
Wagmatcook First Nations Reserve
Alexander Graham Bell National Historic Park
Baddeck Spectacle Island Game Sanctuary
Kempt Head
Boisdale
Middle Trout Brook Wilderness Area
Washabuck River Nature Reserve
Baddeck Inlet
Barra Forest
Shenacadie
Skye River
Washabuck
Little Narrows
McNeil Vale
Grass Cove
Iona
MacFarlane Woods Nature Reserve
MacCormack Park
Washabuck River
Whycocomagh Provincial Park
Whycocomagh First Nations Reserve
Estmere
Malagawatch First Nations Reserve
Benacadie River
Castle Bay
Eskasoni First Nations Reserve
Big Pond
Ben Eoin Provincial Park
Gaspereaux River
Mineral Springs
Fortress of Louisbourg National Historic Park
Wolfes Landing National Historic Site
Bornish Hill Nature Reserve
Gillis Cove
12
Bras d'Or Lake
River Denys
Big Marsh
Orangedale
Melford
Marble Mountain
River Denys
Irish Cove
Mira River
Gabarus
Middle River Framboise Wilderness Area
Gabarus Wilderness Area
Gabarus-Belfry Gut
Belfry Beach
West Bay
Malcolm Cove
Green Island
Hay Cove
Queensville
River Inhabitants Nature Reserve
Dundee
Chapel Island First Nations Reserve
Framboise
Seal Rocks
St. Esprit
Peters
Battery Provincial Park
Cove Road
False Bay
Port Hawkesbury
21

Figure 4.40 Location Map for the Bras d'Or Lakes (Site #12). Basemap layers: land 1: 50 000, 1: 250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); Restricted and Limited Use Land Database Layers (NSDNR 2006b). Refer to Figure 4.1 for legend.


Site Study Areas
Type I
Type II
61°20'W
61°10'W
61°0'W
60°50'W
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60°30'W
60°20'W
60°10'W
46°20'N
46°10'N
46°0'N
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45°40'N
Middle River
North River Wilderness Area
Oregon
North River
Jersey Cove
Bras d'Or
Sieurs De La Boulanderie National Historic Site
Little Bras d'Or
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Big Pond
Rock
Florence Beach
Christies
Lake O'Law
Lake O'Law Provincial Park
South Lake O'Law
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St. Anns Harbour
Kelly
Dalem Lake Provincial Park
Groves Point Provincial Park
North Sydney
Dominion Beach Provincial Park
St. Anne's Provincial Park
Big Harbour
Big Baddeck
St. Andrews Channel
Sydney First Nations Reserve
Petersfield Provincial Park
Inglis Lake
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Big Harbour Beach
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Caribou Marsh Rd
Mira River Provincial Park
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Skye River
Washabuck
Shenacadie
Little Narrows
MacFarlane Woods Nature Reserve
McNeil Vale
Grass Cove
Iona
MacCormack Park
Washabuck River
Whycocomagh Provincial Park
Ben Eoin Provincial Park
Gasperaux River
Whycocomagh First Nations Reserve
Estmere
Malagawatch First Nations Reserve
Benacadie River
Castle Bay
Eskasoni First Nations Reserve
Big Pond
Mineral Springs
Fortress of Louisbourg National Historic Park
Bornish Hill Nature Reserve
Gillis Cove
River Denys
Big Marsh
Orangedale
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Bras d'Or Lake
Wolfes Landing National Historic Site
Melford
Mira River
Gabarus
Irish Cove
Marble Mountain
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Marble Mountain
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Green Island
Malcolm Cove
Hay Cove
Belfry Beach
Gabarus-Belfry Gut
Queensville
River Inhabitants Nature Reserve
Dundee
Chapel Island First Nations Reserve
Framboise
Seal Rocks
St. Peters
St. Esprit
Battery Provincial Park
Cove Road
False Bay
Port Hawkesbury
21
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5
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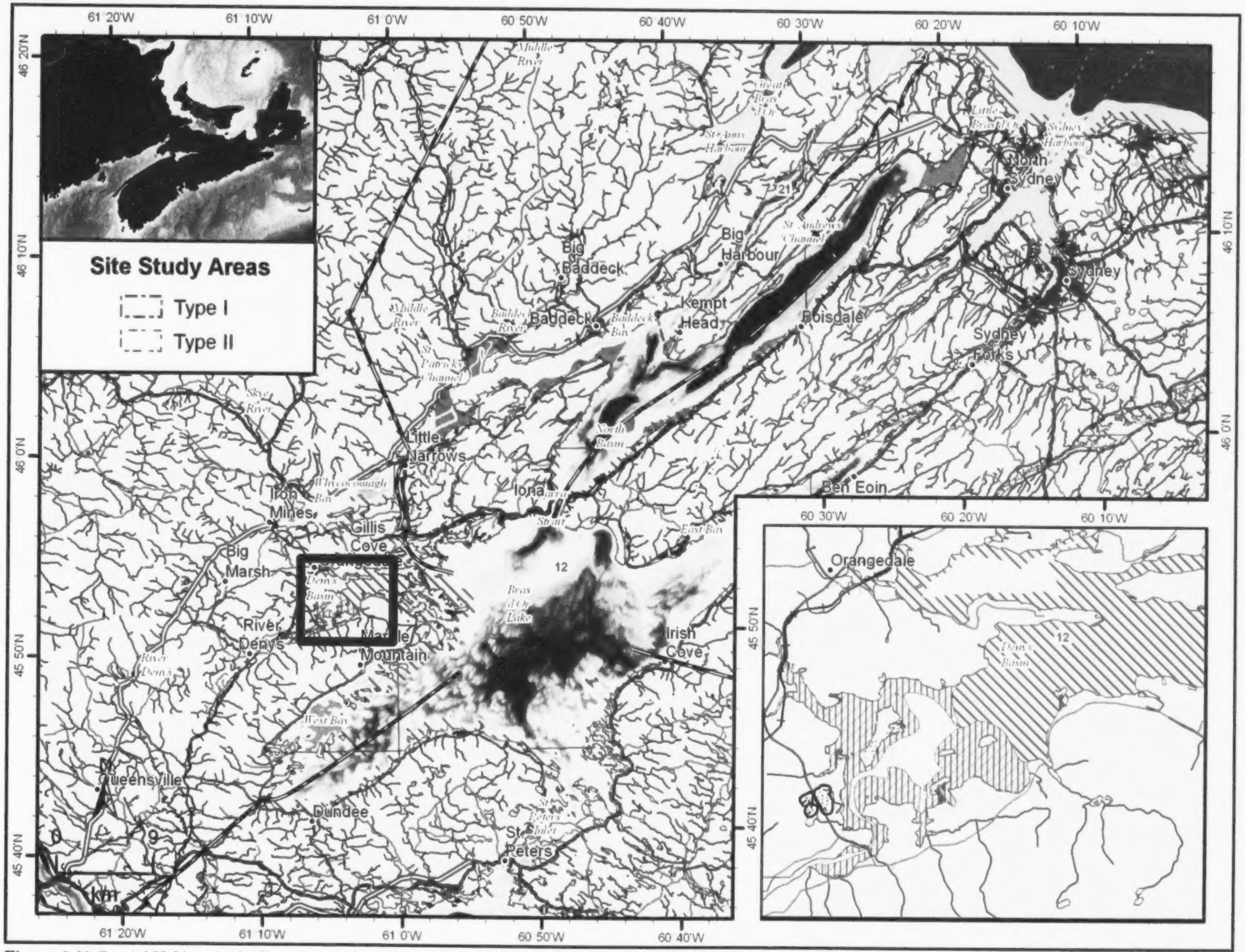
Figure 4.40 Location Map for the Bras d'Or Lakes (Site #12). Basemap layers: land 1: 50 000, 1: 250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); Restricted and Limited Use Land Database Layers (NSDNR 2006b). Refer to Figure 4.1 for legend.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60 40'W
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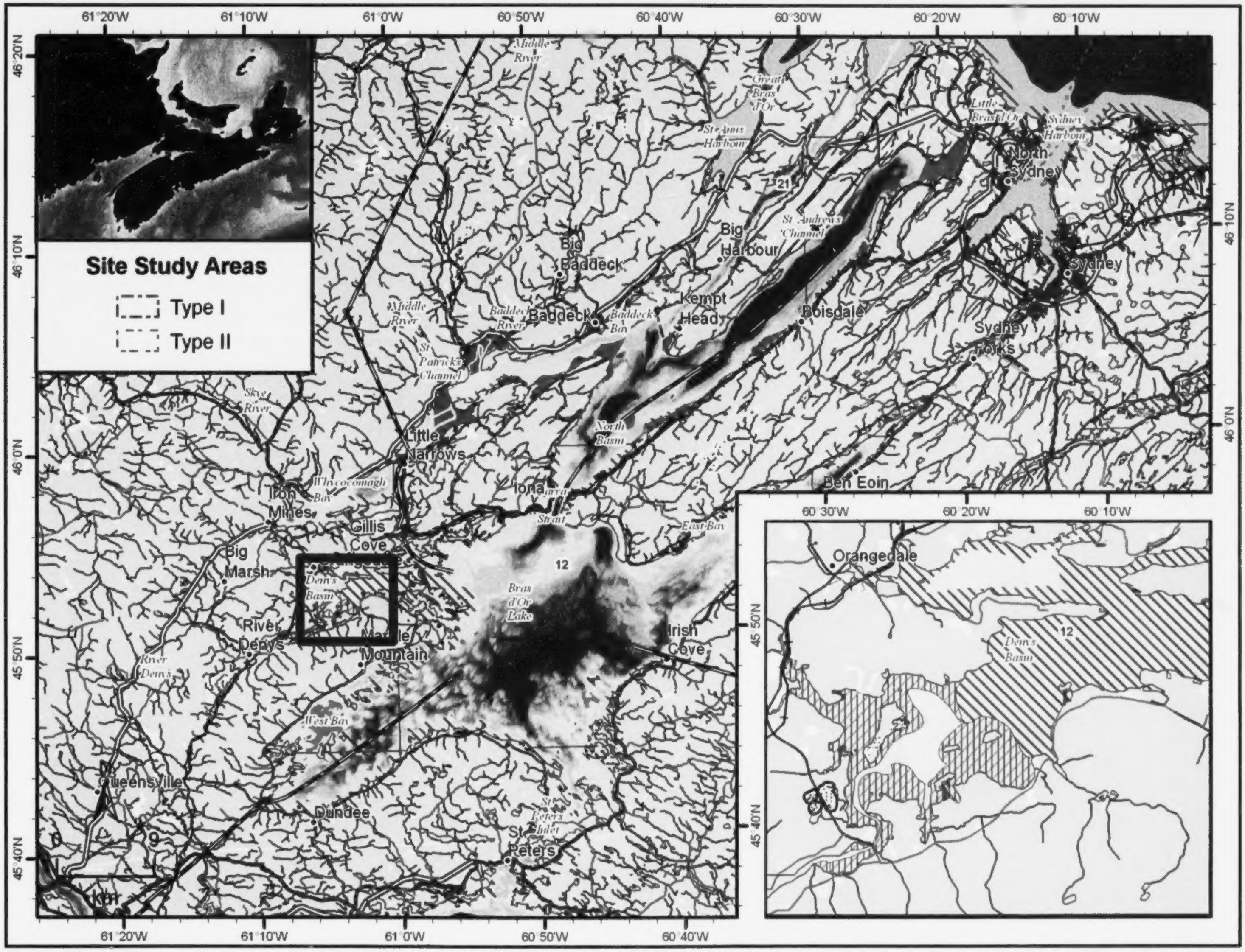
46 20'N
46 10'N
46 0'N
45 50'N
45 40'N
Site Study Areas
Type I
Type II
Middle River
Great Bras d'Or
St Anns Harbour
Little Bras d'Or
Sydney Harbour
North Sydney
21
St Andrews Channel
Big Harbour
Big Baddeck
Baddeck
Baddeck River
Baddeck Bay
Kempt Head
Boisdale
Sydney
Sydney Forks
St Patricks Channel
Skye River
North Basin
Little Narrows
Whycocomagh Bay
Iron Mines
Iona
Barra Strait
Ben Eoin
East Bay
Gillis Cove
Big Marsh
Denys Basin
12
Bras d'Or Lake
River Denys
Marble Mountain
Irish Cove
West Bay
Queensville
Dundee
St Peters Inlet
St Peters
km
Orangedale
Denys Basin

Figure 4.41 Coastal Habitats in the Bras d'Or Lakes (Site #12). Basemap layers: land 1:50 000, 1:250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); NSDNR Wetlands Database layers (NSDNR 2000). Refer to Figure 4.2 for legend.


Site Study Areas
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46°0'N
45°50'N
45°40'N
Middle River
Great Bras d'Or
St. Anns Harbour
Little Bras d'Or
Sydney Harbour
North Sydney
Sydney
21
St. Andrews Channel
Big Harbour
Big Baddeck
Baddeck
Baddeck River
Baddeck Bay
Kempt Head
Boisdale
Sydney Forks
St Patricks Channel
Skye River
Little Narrows
North Basin
Ben Eoin
Whycocomagh Bay
Iron Mines
Iona
Barra Strait
East Bay
Gillis Cove
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Bras d'Or Lake
Irish Cove
River Denys
Marble Mountain
West Bay
Queensville
Dundee
St Peters Inlet
St Peters
km
45°50'N
45°40'N
Orangedale

Figure 4.41 Coastal Habitats in the Bras d'Or Lakes (Site #12). Basemap layers: land 1:50 000, 1:250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); NSDNR Wetlands Database layers (NSDNR 2000). Refer to Figure 4.2 for legend.

Ecological Attributes

The Great Bras d'Or Channel was identified as an EBSA by scientific experts, however, the Bras d'Or Lakes in their entirety were not identified. The channel was only identified one time by scientific experts but it meets three of the five EBSA criteria. It has high degrees of uniqueness and aggregations and medium naturalness (Doherty and Horsman 2007). The Lakes were not identified as a site in Step One of the site selection methodology for this analysis. They were added in Step Two due to the numerous data sources and the focus of the area for an EOAR publication (Parker *et al.* 2007), which indicated that the area is unique and significant for many reasons. Environment Canada has defined an area surrounding the Lakes as a Marine Ecozone of Canada (*Ibid.*). In the recently released *State of Nova Scotia's Coast Technical Report*, the Bras d'Or Lakes were identified as a very unique and highly sensitive ecosystem (CBCL Limited 2009).

The Bras d'Or Lakes are well-known as a unique ecosystem due to the physical properties which make them Nova Scotia's and Atlantic Canada's only inland brackish lake system. Limited circulation and a brackish environment combined with a wide range of depths results in diverse biota and a combination of cold and warm water species, as well as resident and migratory populations (Lambert 2002). Several species that are rare to Nova Scotia are found in the Lakes including oysters, windowpane flounder, Arctic remnant invertebrates, warm water invertebrates, and the algae *Nemalion helminthoides* (*Ibid.*).

The Lakes and surrounding watersheds have spawning areas for cod, herring, mackerel, gaspereau, smelts, alewives, and salmon. There is a distinct population of herring which completes its lifecycle in the Lakes and there is also a population which migrates in and out of the Lakes. TEK demonstrates that there used to be 32 spawning areas and now there are only a few (Parker *et al.* 2007; CEPI 2006), however, some good spawning grounds for smelt and gaspereau still exist (CEPI 2006). Although herring spawning has declined in the Lakes, the area is one of only four current herring spawning areas within the scope of this report and one of seven areas along the coast of Nova Scotia and in the Bay of Fundy (DFO 2008a), however, herring surveys have not occurred in the Lakes since 2000 (DFO 2009d). Little Hope Island in the Port Joli area, Lobster Bay, and a large area off Cole Harbour and the Chezzetcook to Jeddore study areas are also current herring spawning areas (DFO 2008a).

Juvenile species take refuge in the area. In ichthyoplankton surveys the most abundant ichthyoplankton were four-bearded rockling, winter flounder, cod, and smelt (Parker *et al.* 2007). Other resident species which are reared in the Lakes include herring and windowpane flounder (Lambert 2002). There is evidence that white hake, which is not likely a resident species in the Lakes, uses the Lakes as a nursery area (*Ibid.*). There are substantial numbers of winter flounder in the Lakes (T. Lambert, DFO Science Branch, pers. comm. 2010). There is also indication that eelgrass beds in the Lakes may be important for cod, herring, and white hake (Parker *et al.* 2007). Although marine plants are minimal in the Lakes, with the exception of some rockweed and floating kelp, there are numerous but scattered salt marshes and eelgrass beds (*Ibid.*). According to TEK, eelgrass is an important spawning area for herring; eelgrass beds have reduced in size and shifted locations over time (CEPI 2006).

There are several other species which aggregate in the Lakes including feeding grey and harbour seals, breeding waterbirds, seabirds, and shorebirds; and other epibenthic invertebrates (Parker *et al.* 2007). There are also lobsters and scallop beds in the Lakes, but in minimal quantities (*Ibid.*). The low salinity likely limits the distribution of several invertebrate species, however, there is a considerable abundance of urchins and starfish in the Lakes, as indicated by trawl survey data (Tremblay 2002). Although there is a low abundance of lobster in the Lakes in comparison with other sites in this analysis, there is a relatively high proportion of large, egg bearing females in West Bay (Tremblay *et al.* 2005). Tremblay *et al.* (2005) conducted dive and underwater video bottom transects at various locations within the Bras d'Or Lakes and near Cape Dauphin, just outside of the Lakes. They found that although densities of lobster were higher at Cape Dauphin (0.019 lobsters per m^2) than in West Bay (0.002 lobsters per m^2), West Bay had a much higher proportion of egg-bearing females (25%) compared to the proportion at Cape Dauphin (6%).

Two COSEWIC-assessed species are found in the Bras d'Or Lakes: Atlantic cod (endangered) (one or two resident populations), and winter skate (threatened). The greatest numbers of species at risk in the Lakes are found in St. Patrick's Channel (Parker *et al.* 2007).

Although the Lakes are not surrounded by extensive development, TEK indicates that poor land-use practices have been the cause of numerous changes to the Bras d'Or Lakes Ecosystem including the decline in salt marshes and eelgrass beds and poor water quality (CEPI 2006; Parker *et al.* 2007). The naturalness of the area has been impacted. Changes in the ecosystem are noted in the Bras d'Or Lakes TEK Workshop Proceedings (CEPI 2006).

Within the Bras d'Or Lakes ecosystem there may be areas with more ecological importance than others. St. Andrew's Channel was identified as a potential EBSA and scored the highest of all areas assessed in a draft scoring exercise. The results of this exercise were intended to be included in the EOAR for the Bras d'Or Lakes but were eventually excluded. The Great Bras d'Or Channel scored the second highest and was also identified as a potential EBSA.

Bird Information

This area does not coincide or otherwise overlap with presently identified IBAs. No significant concentrations of colonial nesters are found in this area. Conversely, important numbers of breeding Common and Arctic Terns nest here, as do important numbers of Great Black-backed Gull, Herring Gull, Great Blue Heron, and Double-crested Cormorant. Numbers of geese are typically very low, with a high count recorded north of West Bay. Dabbling duck counts are generally high in the northeast and southeast, and low elsewhere. High numbers of bay ducks have only been recorded around Big Harbour in the north, and are otherwise generally absent. Sea duck counts are typically low.

Important Marine Ecological Features:

- Unique ecosystem: Atlantic Canada's only inland brackish lake system
- Spawning areas for cod, herring, mackerel, gaspereau, smelts, alewives, and salmon
- Nursery area for four-bearded rockling, winter flounder, cod, smelt, herring, windowpane flounder, and white hake
- Several rare species in Nova Scotia: oysters, windowpane flounder, Arctic remnant invertebrates, and warm water invertebrates
- Distinct population of herring (resident of Bras d'Or Lakes)
- Aggregations of grey and harbour seals
- COSEWIC-assessed species: Atlantic cod (endangered) and winter skate (threatened)
- Several eelgrass beds (although declining) and salt marshes

Human Uses

The Bras d'Or Lakes are a large area and contain several human uses including coastal development, mining, fishing, aquaculture, shipping, tourism, and recreation. The largest scale human use is coastal development. According to Parker *et al.* (2007), "the most impacted area of the Lakes appears to be the nearshore fringe where science has documented conditions of coliform pollution, sedimentation, metals, isolated areas of anoxia and hypoxia, other stressors such as road development, shoreline development, and various resource use and extraction."

TEK indicates that these activities (especially coastal development) are associated with shifts and reduction of eelgrass beds, salt marshes, and herring spawning grounds which have gone from approximately 32 to very few today (CEPI 2006). There have also been declines in numbers of herring, cod, salmon, eels, oysters, gaspereau, smelt, trout, lobster, urchins, quahogs, clams, flounder, skate, and minnow, according to TEK (*Ibid.*). Poor water quality and climate change have significantly affected the Bras d'Or Lakes ecosystem (*Ibid.*).

Coastal Development

Although portions of the area have low development and a low population compared to other areas of the province, there are concerns that unplanned development continues to threaten the nearshore ecosystems of the Bras d'Or Lakes (Parker *et al.* 2007; CEPI 2006). Road and shoreline development as well as resource extraction have caused a multitude of problems including documented coliform pollution, sedimentation, metals, isolated areas of anoxia and hypoxia, and the disappearance and reduction of wetlands and eelgrass beds (*Ibid.*). Baddeck and St. Peters have central sewage treatment plants. Treatment plants also exist in Whycocomagh and Evanston (Parker *et al.* 2007).

Surrounding municipalities for the most part lack municipal planning strategies and land use bylaws (see Appendix D) (CBCL Limited 2009). Cape Breton Regional Municipality and a portion of the Municipality of the County of Richmond are the exceptions with both municipal planning strategies and land use bylaws (*Ibid.*).

The area may have potential for wind energy development, with high wind speeds of 8.01-8.5 m/s throughout much of the lake area and speeds up to 9.0 m/s in some areas of the Lakes (Province of Nova Scotia 2010).

Mining

There is substantial gypsum mining in Melford and Little Narrows and a red marble quarry at Kennedy's Big Brook. The two gypsum mines in the watershed supply 31% of Nova Scotia's production and employ 220 people (Parker *et al.* 2007).

There are small exploratory mineral licenses in many areas onshore. There is also quite a bit of salt and potash mineral interest in St. Andrews Channel and West Bay. There are "Special Licenses" for those areas which are pending application (Parker *et al.* 2007).

St. Patrick's Channel was recently dredged near MacIvers Point not far from the Little Narrows gypsum plant and also adjacent to the loading dock. Controversial dredging also took place on Middle Shoal just outside the Lakes at the entrance to the Great Bras d'Or Channel (T. Lambert, DFO Science Branch, pers. comm. 2010).

Mining may affect the Lakes through pollution, sedimentation, interrupting the physical properties such as salinity, and other impacts associated with shipping minerals.

Commercial Fishing

Fisheries in the Bras d'Or Lakes have declined over the years resulting in a closure of all mobile gear in the Lakes and the closure of the herring fishery (Parker *et al.* 2007; CEPI 2006). Currently, very few fisheries exist and the main fisheries are for rock crab, oyster, and some lobster. A very small amount of groundfish is also caught nearshore, but this is a very small area of the Great Bras d'Or Channel (VDC 2009; DFO 2005a) and may be an error in the logbook data. The Great Bras d'Or Channel is the primary location for the rock crab fishery which makes up the majority of commercial landings in the Lakes (VDC 2009; DFO 2005a).

LFA 28 contains the area south of the Barra Strait and LFA 27 contains the area north of the Strait. The Bras d'Or Lakes only make up a portion of LFA 27 and the landings for the Lakes are not recorded separately from the rest of the LFA (Parker *et al.* 2007). LFA 28 makes up less than 1% of landings of LFAs 27-30 combined and therefore significantly less than the rest of the landings caught across the Atlantic Coast of Nova Scotia. In grid squares 363-368, the reporting units within LFA 28, 2008 lobster landings are estimated at 16 MT. These landings comprise 0.05% of 2008 landings in the Maritimes Region. LFA 28 comprises 0.04% of 2008 landings in the Maritimes Region (VDC 2009).

There are two types of oyster fishery: (1) the relay fishery when special licenses are issued by DFO for the relocation of oysters from contaminated areas to areas leased for aquaculture where they can be harvested for public consumption after clearing themselves of contaminants and (2) the commercial/recreational fishery for which licenses are issued and occurs on approved, uncontaminated oyster beds.

In 2001 the relay fishery consisted of up to 14 licenses which yielded 36,016 kg in landings and the commercial fishery yielded 17,638 kg from 56 harvesters (Parker *et al.* 2007). The commercial and relay harvests in 2004 yielded 20,500 kg and a small harvest was expected for 2005 (*Ibid.*). More recent landings within the study area were not possible to obtain for this report. Landings by Statistical District are available, however, they do not match the study area boundaries. Although landings have been lower in recent years, the oyster fishery is considered a major fishery in the Bras d'Or Lakes (M. Butler, Fisheries and Aquaculture Management Branch, pers. comm. 2010).

In 1990 a survey indicated there were 169 full and part-time commercial fish harvesters in the region (Parker *et al.* 2007). Species fished at that time included cod, herring, mackerel, eel and lobster. Mackerel and much of the herring was fished primarily for lobster bait. Fisheries are a minor human use in the Bras d'Or relative to other areas. Commercial bottom trawling was banned in 1992 and the herring fishery has been completely closed since 2000 (*Ibid.*). There are only six wharves in the area, which are for both fishing and recreation (CCN 2006). There are few wharves in the area compared to other study areas, indicating a lower fishing intensity than other regions.

First Nation and Recreational Fisheries

The Cape Breton First Nations participate mainly in the commercial oyster fishery and also in the commercial lobster fishery (UINR 2010; Parker *et al.* 2007). There are also food, social, and ceremonial (FSC) fisheries for salmon and eel within the Lakes (*Ibid.*). The Unama'ki Institute of

Natural Resources (UINR) is supportive of a ban on FSC salmon fishing in Middle and Baddeck Rivers in recognition of declining wild populations (UINR 2010). The Assembly of Mi'kmaq Chiefs is calling for an end to the recreational fishery for salmon in these rivers, which is also supported by the UINR (*Ibid.*).

There are recreational fisheries for American eel, mackerel, smelt, and salmon in the Lakes (Parker *et al.* 2007).

Table 4.23 provides a summary of commercial fisheries in the Bras d'Or Lakes.

Table 4.23 Summary of Major Commercial Fisheries and Gear Used in the Bras d'Or Lakes

Species	**Landings***	**Gear**	**Year**	**Source**
Rock crab	M	Pot	1999-2003 2007-2009	DFO 2005a VDC 2009
Lobster	L	Pot	2008	VDC 2009
Oyster	M	Rakes and tongs	N/A	Parker *et al.* 2007

*H = high, M = medium, L = low

Aquaculture

There are 105 licensed aquaculture sites issued in the Bras d'Or Lakes and 2 proposed licenses (see Figure 4.42, Service Nova Scotia 2008). Oyster aquaculture makes up the majority of the sites with 99 issued and two proposed licenses for a total of 339.13 ha (3.39 km^2). Atlantic salmon and Rainbow Trout make up the other six licenses, however, all of the license holders are under review (Service Nova Scotia 2008) and the sites are therefore assumed to be inactive. The finfish sites total 40.12 ha (0.42 km^2). The total aquaculture footprint for the Lakes is 3.79 km^2 or 0.35% of the total area, including both proposed and issued licenses.

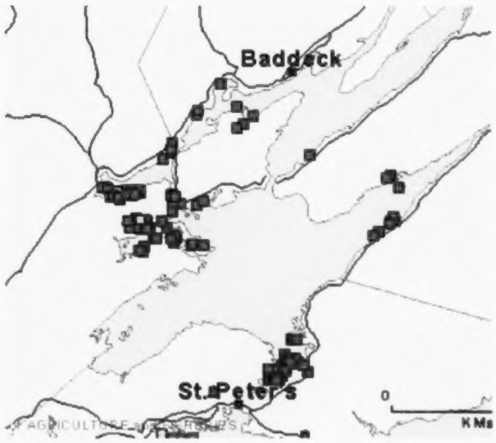


Figure 4.42 Aquaculture Licenses/Leases in the Bras d'Or Lakes (denoted by green squares) (Service Nova Scotia 2008)

According to Parker *et al.* (2007), finfish aquaculture once occurred in the Bras d'Or Lakes but at the time of writing the only operations were for oysters. Past finfish aquaculture resulted in the introduction of rainbow trout (Parker *et al.* 2007).

There were several active aquaculture licenses in the Lakes historically, but currently only 15% of licenses are active, mainly due to MSX and SSO (see below: *Invasive Species*) disease outbreaks (Parker *et al.* 2007). Most licenses are in Denys Basin with significant numbers in Whycocomagh Bay and St. Peter's Inlet.

Invasive Species

It is believed that invasive species of tunicates, green crab, and the parasites MSX (multinucleated sphere which has been identified as *Haplosporidium nelsoni*) and SSO (seaside organism) were introduced primarily by dumping of ballast water in the Lakes, which is now illegal under the Ballast

Water Control and Management Regulations (CEPI 2006; Parker *et al.* 2007). There is concern that green crabs are destroying eelgrass stands which are believed to support herring populations as well as several other juvenile fish species (*Ibid.*).

Shipping

Large-scale shipping is mainly attributed to mining operations through the transport of materials. The three entry points for ships include St. Peter's Canal and Big Bras d'Or Channel where industrial ships pass, and the narrow Little Bras d'Or Channel where small local boats pass. Only 45 vessels enter the Lakes every year from May to December, mainly for the transport of gypsum (Parker *et al.* 2007). A small vehicle ferry passes across Little Narrows and there are several recreational boats that operate throughout the Lakes (*Ibid.*).

Oil and Gas

Oil and gas exploration was conducted by Chevron Canada Resources in 1980 throughout Bras d'Or Lake over 462 km but was not further developed (Parker *et al.* 2007).

Tourism, Recreation, and Culture

There is a substantial First Nations population in this watershed. Areas identified as significant for First Nations include Chapel Island and Malagawatch (on the peninsula between West Bay and Denys Basin) (CEPI 2006). Malagawatch is a burial ground, meeting site and former trading place, contains medicinal plants such as sweetgrass, and is used as a retreat. These two were highlighted, but a list of 40 significant sites came out of the Bras d'Or Lakes Collaborative Environmental Planning Initiative (CEPI) TEK workshop (*Ibid.*).

Other cultural sites include the Alexander Graham Bell National Historic Site near Baddeck. St. Peter's Canal is also a National Historic Site (Parker *et al.* 2007). Baddeck is a cruise ship destination, however cruise ship visits are minimal compared to Halifax (DFO 2005a).

Recreational boating is popular; there is a Bras d'Or Yacht Club in Baddeck and there are four other recreational boating facilities. There are also sailing and yachting tours. Approximately 625 boats traverse St. Peter's Canal annually (Parker *et al.* 2007). There is one substantial SCUBA operation, The Cape Breton Nervous Wrecks Dive Club, which operates from Sydney. There are approximately 19 shipwrecks in the Lakes which regularly attract divers. There is also a salmon fishing lodge in Baddeck and North Rivers (Green Highlander Lodge) and saltwater sport fishing is also popular in the Lakes. There are sea kayak rentals in West Bay (Parker *et al.* 2007).

There are three golf courses in the watershed. There are 1 million visitor trips made annually to Cape Breton. Tourism in Cape Breton as a whole generates 6800 jobs (ECBC 2003).

Current Protection and Research/Conservation Initiatives

There are some existing terrestrial protected areas near the Bras d'Or Lakes which are listed below:

- St. Peter's Inlet: Battery Provincial Park, St. Peter's Canal National Historic Site
- St. Patrick's Channel: Spectacle Island Game Sanctuary (extends 100 m into the water from the ordinary high water mark); Alexander Graham Bell National Historic Site; Ross Ferry Provincial Park; Barrachois Provincial Park; Groves Point Provincial Park;
- Sydney Harbour: Petersfield Provincial Park
- Wycocomagh Provincial Park
- Middle River: Middle River Wilderness area (largest: 5340 ha)
- A number of Non-designated Parks and Park Reserves and Protected Beaches
- NSNT lands in Washabuck (72.84 ha total, 2.54 km of protected shoreline) (NSNT 2009) (NSDNR 2006b; Service Nova Scotia 2006)

Lane and Associates (1992) identified the Bras d'Or Lakes, among 16 other areas, as a potential site of significance during an initial scoping exercise, but later dropped the area prior to making its recommendations to Parks Canada. Parks Canada is not currently pursuing an NMCA designation in the Scotian Shelf marine region.

The Bras d'Or Lakes is considered a coastal management area (CMA) within the Eastern Scotian Shelf Large Ocean Management Area (LOMA) (Parker *et al.* 2007). Efforts to develop an integrated management (IM) plan for the Bras d'Or Lakes through the CEPI (CEPI 2009) provide an opportunity for complementary protection on land and sea.

There are several organizations in the area which promote or take part in stewardship and conservation initiatives including:

> *The Unama'ki Institute of Natural Resources (UINR)* represents the five First Nations communities in Cape Breton and was formed to increase First Nation involement in natural resources management and to address concerns regarding natural resources and their sustainability (UINR 2010).
> *The Bras d'Or Stewardship Society* is a membership organization that promotes "accountable and responsible stewardship of the Bras d'Or Lakes and its watershed".
> *The Bras d'Or Preservation Society* intends to establish conservation easements in the Bras d'Or watershed.
> *The Pitu'paq Committee* represents the five First Nation Chiefs and the five Mayors and Wardens in Cape Breton. They have focused on sewage management.
> *The Bras d'Or Lake Biosphere Reserve Association.* A UNESCO Biosphere Reserve Nomination was submitted on August 17, 2009 for the entire watershed of the Bras d'Or Lakes (The Bras d'Or Lake Biosphere Reserve Association 2009).

There is general support for the Biosphere Reserve Proposal which is demonstrated by the numerous sectors represented in the Bras d'Or Lake Biosphere Reserve Association (2009) including the UINR, Eskasoni Fish and Wildlife, Georgia-Pacific Ltd. (gypsum mining), CEPI, and the Bras d'Or Stewardship Society. Interestingly, Denys Basin was once a proposed MPA for the protection of important oyster beds (The Bras d'Or Lake Biosphere Reserve Association 2009).

Concern for the health of the Bras d'Or Lakes watershed and the need for effective management have been expressed in various CEPI workshops as demonstrated below:

> *"A holistic view to managing activities on the Lakes is necessary"*
>
> *"The Bras d'Or is a unique and sensitive system that requires protection"*
>
> *"…we need to leave Mother Nature alone to give her a chance to heal herself."*
>
> - CEPI 2004, 2006

Although there are some research gaps in the Bras d'Or Lakes, information is more readily available for the Bras d'Or Lakes site than the other twenty sites in this report mainly due to the EOAR by Parker *et al.* (2007) and the earlier compliation of scientific studies in the Bras d'Or Lakes presented in the Proceedings of the Nova Scotia Institute of Science, Volume 42 (Petrie 2002).
DFO and the UINR collaborated in the past on a variety of research initiatives in the Bras d'Or Lakes (DFO 2008C) and the CEPI recently held a workshop in Wagmatcook on April 28-29, 2009, *Research and Monitoring in the Bras d'Or Lakes 2009: Looking Forward – Working Together*, to identify research priorities for the Bras d'Or Lakes. This follows a workshop that took place in 1999 that identified research priorities that helped establish the Science for the Integrated Management of the Bras d'Or Lake (SIMBOL) program. Historic research is summarized combined with recent work carried out under the auspices of SIMBOL in an issue of the Proceedings of the Nova Scotia Institute of Science (Vol. 42, part 1; 2002) (Petrie 2002). The following priorities were identified by Naug (2009) in the draft proceedings for the 2009 workshop: Nearshore Habitats, Fish and Fishery, Land-Use, Invasive Species, Communications, and a Framework to Integrate TEK and Western Science.

Eelgrass was mapped by DFO Science Branch and the UINR around all of the First Nations Reserves in the Bras d'Or Lakes using sidescan sonar and video. There are plans to continue mapping eelgrass throughout the Bras d'Or in the coming years. In October 2009 work was planned to continue mapping eelgrass in Whycocomagh Bay through to St. Patrick's Channel.

DFO Science is exploring the utility of Ocean Colour Satellite data in coastal regions to examine the distribution of suspended sediment and harmful algal blooms using the satellite sensor Medium Resolution Imaging Spectrometer (MERIS). This work may be applied in the Bay of Fundy, the Bras d'Or Lakes, Northumberland Strait and some Lakes in Nova Scotia. The project is in the exploratory stage (G. Bugden, DFO Science Branch, pers. comm. 2010).

In addition to the aforementioned projects, DFO Science is running moorings in the Lakes to provide data for a collaborative research initiative with Cape Breton University (CBU) and Dalhousie University primarily to calibrate and validate a numerical circulation model developed at Dalhousie (G. Bugden, DFO Science Branch, pers. comm. 2010). DFO Science and CBU are also running monitoring stations in the Lakes as part of the Atlantic Zone Monitoring Program (AZMP) (*Ibid.*) which is a comprehensive environmental monitoring program with three fixed stations in the Maritimes Region (Therriault *et al.* 1998). The Halifax station is the only station located in the study area for this report and there is no overlap with any of the twenty Type I and II sites.

Summary

Table 4.24 below summarizes the key information provided in the site profile. The Bras d'Or Lakes meet all of the *Oceans Act* criteria for MPA establishment and is the most unique site of all twenty sites in this report; the Lakes are Nova Scotia's (and Atlantic Canada's) only inland brackish lake system. The study area is very large and there are several human uses that occur in the area. TEK indicated that the health of the Bras d'Or Lakes ecosystem has declined significantly. There are ongoing initiatives to address this issue through improved coastal and ocean management.

Table 4.24 Summary of the Bras d'Or Lakes Site Profile

***Oceans Act* Criteria (s.35)**	**Ecological Attributes**	**Human Uses**	**Current Protection and Research Initiatives**
(a) The conservation and protection of commercial and non-commercial fishery resources, including marine mammals, and their habitats; (b) The conservation and protection of endangered or threatened marine species, and their habitats (c) The conservation and protection of unique habitats; (d) The conservation and protection of marine areas of high biodiversity or biological productivity	• Unique ecosystem: Atlantic Canada's only inland brackish lake system • Spawning areas for cod, herring, mackerel, gaspereau, smelts, alewives, and salmon • Nursery area for four-bearded rockling, winter flounder, cod, smelt, herring, windowpane flounder, and white hake • Several rare species in Nova Scotia: oysters, windowpane flounder, Arctic remnant invertebrates, and warm water invertebrates • Distinct population of herring (resident of the Lakes) • Aggregations of grey and harbour seals • COSEWIC species: Atlantic cod and winter skate • Several eelgrass beds (although declining) and salt marshes	• Commercial fishing - rock crab - oyster - minimal lobster • Recreational fishing - eel - mackerel - smelt • First Nation fishing - eel (FSC) - salmon (FSC) - lobster and oyster (commercial and FSC) • Some coastal development • Mining for gypsum and red marble • Potential for salt and potash mining • Shipping (mainly associated with gypsum mining) • Several oyster aquaculture licenses • Dredging • Tourism • Many sites of First Nations significance • Recreation including boating, SCUBA diving, and fishing	• Collaborative Environmental Planning Initiative (CEPI) for Integrated Management planning of the Lakes • Ongoing research initiatives; several new research projects identified that are conducive to conservation planning (eelgrass mapping) • UNESCO Biosphere Reserve Proposal • Several terrestrial protected areas • Several active stewardship and conservation organizations

4.13 Port l'Hebert

Port l'Hebert is known for its importance for migratory birds, especially the American Black Duck and Canada Goose, as is neighbouring Port Joli. The endangered Harlequin Duck also frequents the area. There is a MBS managed by CWS at the head of the inlet for the protection of these birds. There is little information on the marine environment, except for the presence of extensive eelgrass beds. It is also thought to be an important area for lobsters. There are very few human uses in the area including lobster fishing and recreational activities.

Location and Population

Port l'Hebert is located along the scenic Lighthouse Route in southwest Nova Scotia, and sits on the border between Queens and Shelburne Counties. The total study area is 10.8 km^2 and comprises the entire Port l'Hebert inlet. The study area does not extend seaward beyond Stuart's Point and Green Side Shore. See Figure 4.44 for the location map of Port l'Hebert. It is situated almost exactly halfway between Liverpool and Shelburne, the two nearest towns, with Liverpool approximately 34 km to the northeast and Shelburne approximately 32 km to the southwest. Lockeport is another town found just a few kilometres closer than Shelburne. The area has a low population density of 0-10 people per km^2 (Municipal Services 2001). The population of Port l'Hebert could not be found, however, it is assumed to be very small, similar to Port Joli.

Physical and Oceanographic Attributes

The study area makes up a significant portion of the Port l'Hebert inlet which has a total area inshore from Stuart's Point and Green Side Shore of approximately 12.2 km^2 including intertidal areas. The inlet is predominately intertidal with a maximum depth of 10.1 m (see Figure 4.43). The inlet has freshwater input with a watershed drainage area of 90.8 km^2, a tidal to freshwater ratio of 237.7:1, and a high flushing time of 25.4 hours (DFO 2007d). Port l'Hebert is classified as an Intermediate Mixed Bay (Greenlaw 2009).

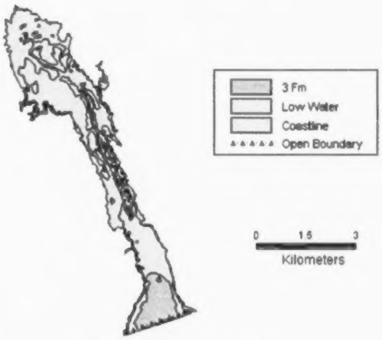
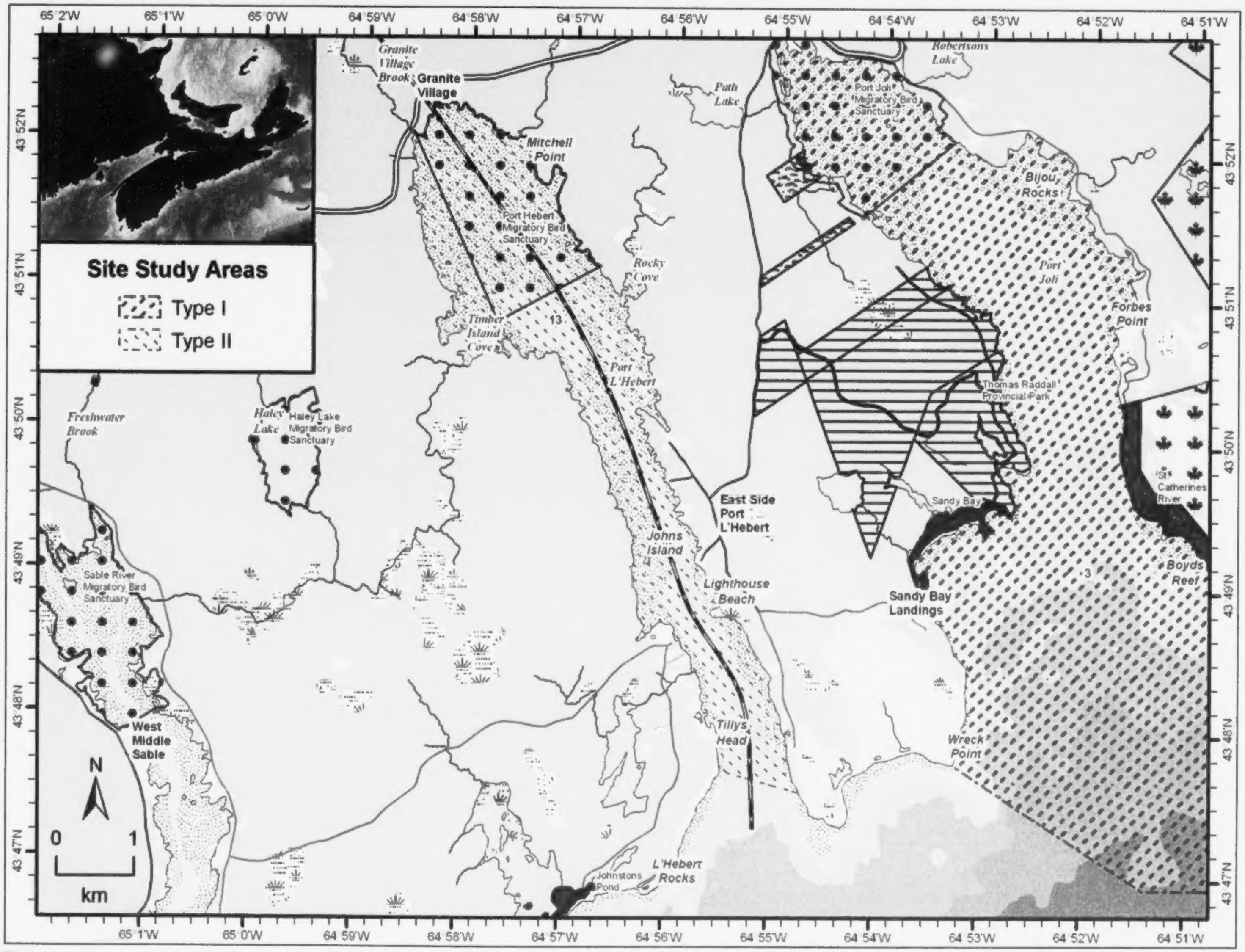


Figure 4.43 Port l'Hebert Bathymetry (DFO 2007d) 1 Fm = 1.83 m , Coastline = intertidal zone

The Port l'Hebert inlet shares the same physical characteristics of the Port Joli and Cape Sable Island areas, which is typical of Nova Scotia's south shore. The dominant bedrock is greywacke with granite intrusions and the terrain has very little relief but has an indented coastline with long narrow inlets that are drowned river estuaries (Davis and Brown 1996b). There are very few glacial deposits. The coast is a high energy wave environment and consists of dunes, flat sand beaches, and tidal marshes. The area experiences higher temperatures than the rest of the Atlantic coast (Davis and Brown 1996b).

The study area contains a diversity of habitats including abundant and extensive estuarine and marine flats containing salt marshes and eelgrass beds. See Figure 4.45 for an illustration of these features. The only beach in the inlet is Lighthouse Beach on the east coast. Sediment in the area is relict glacial sediment and very little is derived from coastal erosion (Davis and Browne 1996b), resulting in high sensitivity to sea level rise (NRCan 2007). Port l'Hebert has extensive intertidal and subtidal mudflats which are important for the growth of eelgrass that supports the overwintering Canada Goose (Environment Canada 2004).


Site Study Areas
Type I
Type II
Granite Village Brook
Granite Village
Mitchell Point
Port Hebert Migratory Bird Sanctuary
Rocky Cove
Timber Island Cove
13
Port L'Hebert
Path Lake
Robertsons Lake
Port Joli Migratory Bird Sanctuary
Bijou Rocks
Port Joli
Forbes Point
Thomas Raddall Provincial Park
Sandy Bay
St. Catherines River
Boyds Reef
Sandy Bay Landings
East Side Port L'Hebert
Johns Island
Lighthouse Beach
Tillys Head
Wreck Point
Johnstons Pond
L'Hebert Rocks
Freshwater Brook
Haley Lake
Haley Lake Migratory Bird Sanctuary
Sable River Migratory Bird Sanctuary
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64°51'W
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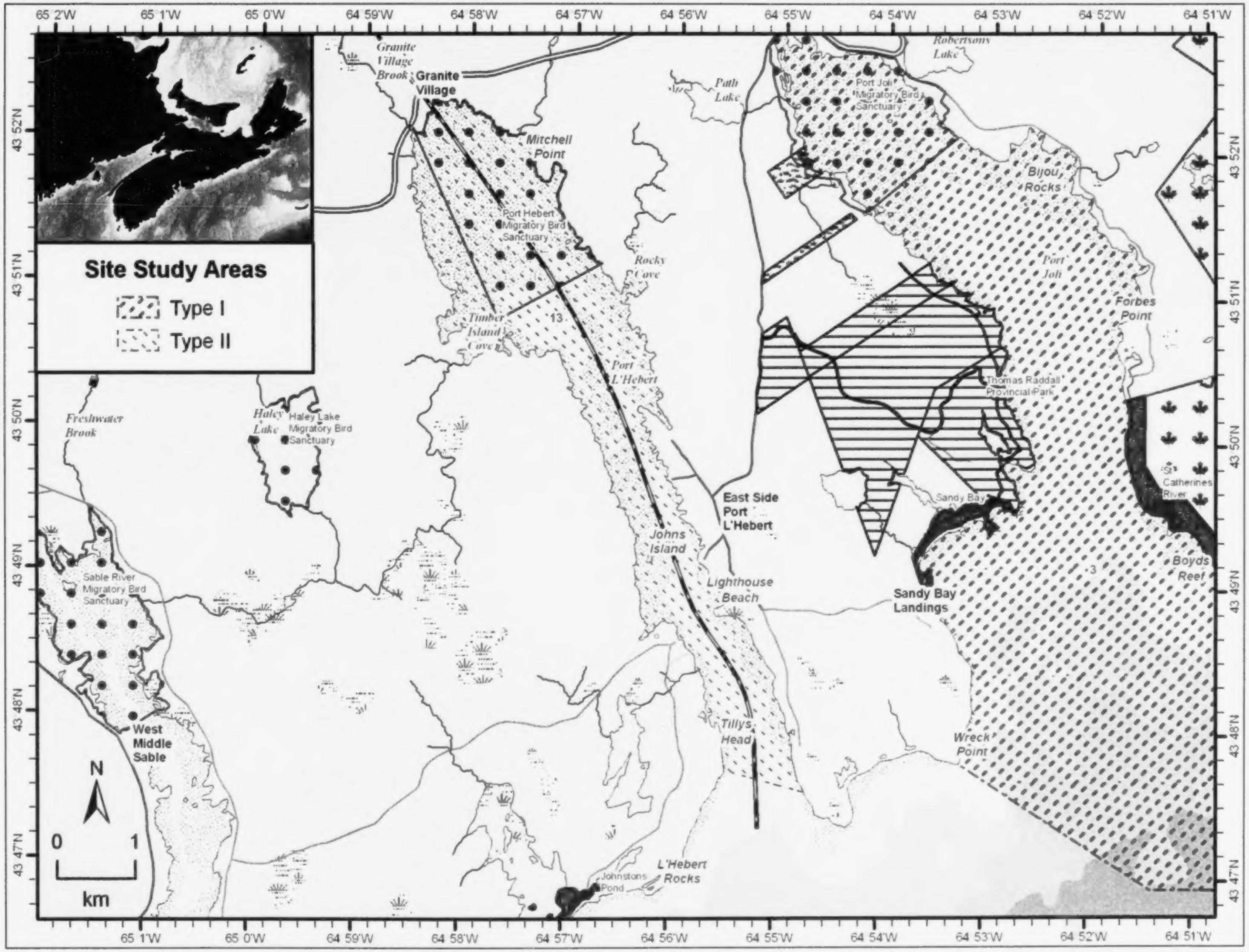
43°48'N
43°47'N

Figure 4.44 Location Map for Port l'Hebert (Site #13). Basemap layers: land 1: 50 000, 1: 250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); Restricted and Limited Use Land Database Layers (NSDNR 2006b). Refer to Figure 4.1 for legend.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Wreck Point
Freshwater Brook
Haley Lake
Haley Lake Migratory Bird Sanctuary
Sable River Migratory Bird Sanctuary
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64 51'W
43 52'N
43 51'N
43 50'N
43 49'N
43 48'N
43 47'N

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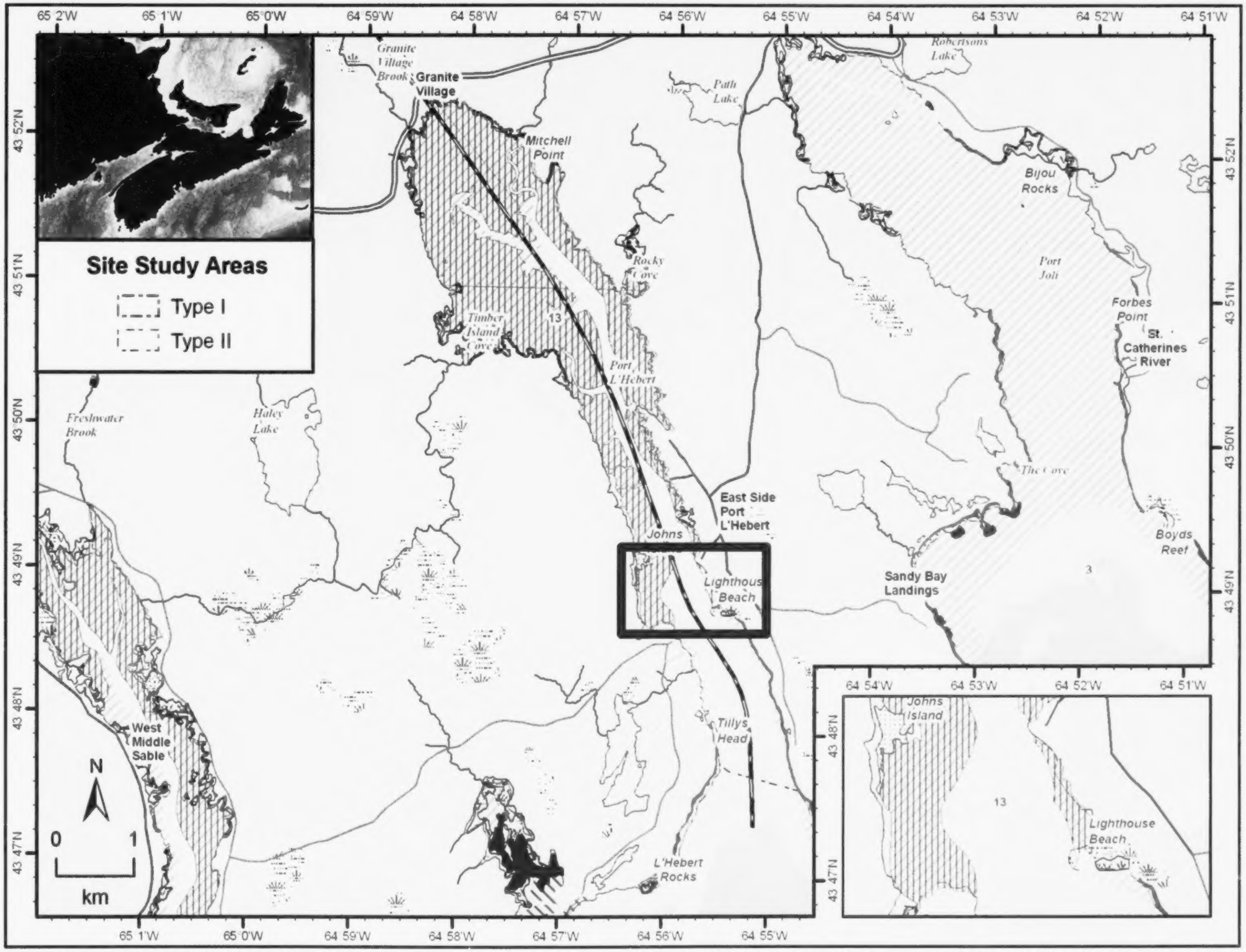
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Freshwater Brook
Bijou Rocks
Port Joli
Forbes Point
St. Catherines River
The Cove
East Side Port L'Hebert
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Lighthouse Beach
Sandy Bay Landings
Boyds Reef
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Tillys Head
L'Hebert Rocks
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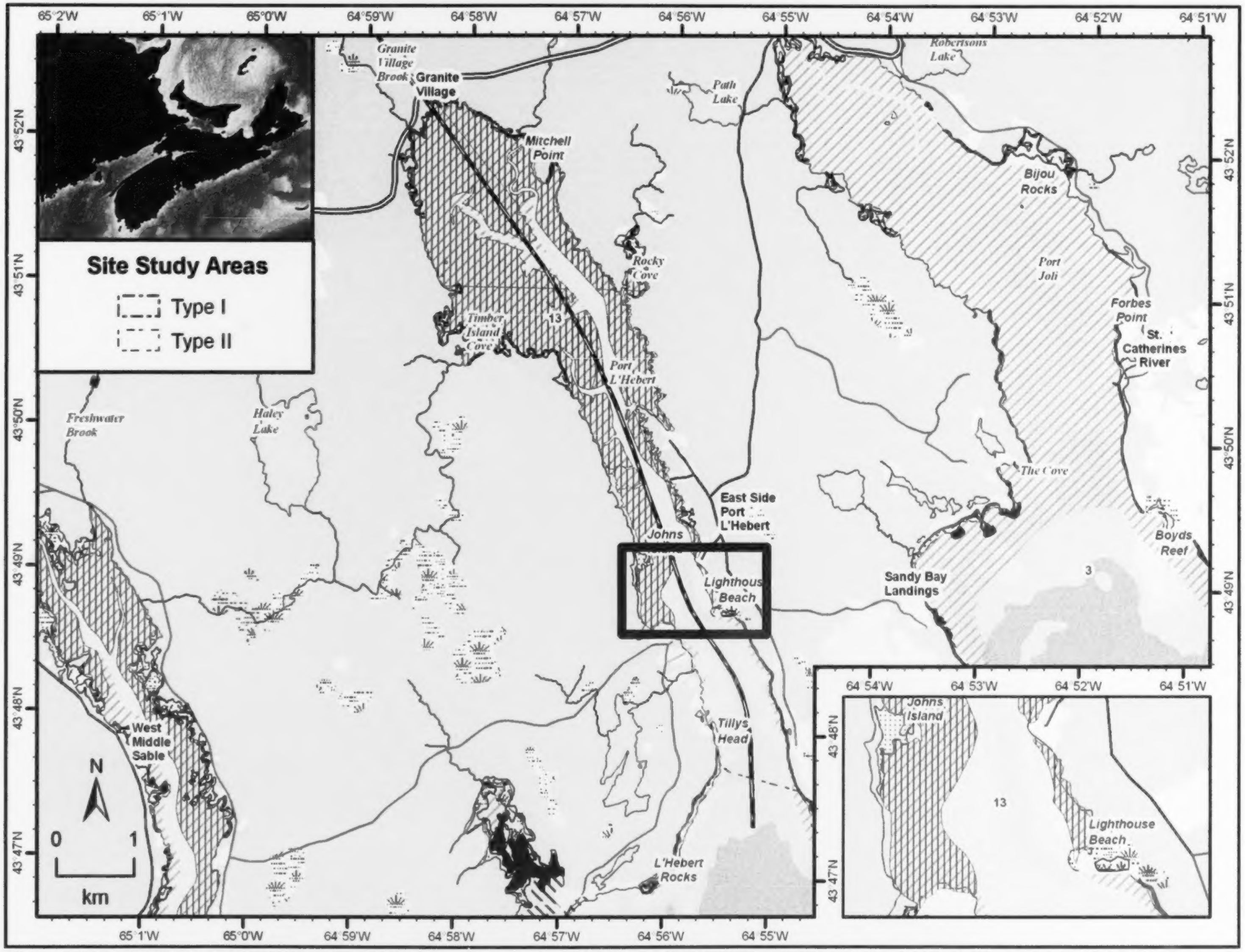
64 53'W
64 52'W
64 51'W
43 52'N
43 51'N
43 50'N
43 49'N
43 48'N
43 47'N

Figure 4.45 Coastal Habitats in Port l'Hebert (Site #13). Basemap layers: land 1:50 000, 1:250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); NSDNR Wetlands Database layers (NSDNR 2000). Refer to Figure 4.2 for legend.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65°0'W
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64°52'W
64°51'W
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43°48'N
43°47'N
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Tillys Head
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Johns Island
Lighthouse Beach

Figure 4.45 Coastal Habitats in Port l'Hebert (Site #13). Basemap layers: land 1:50 000, 1:250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); NSDNR Wetlands Database layers (NSDNR 2000). Refer to Figure 4.2 for legend.

Ecological Attributes

Port l'Hebert was identified by scientific experts as an EBSA. It meets all of the EBSA criteria from a low to high degree (it has high aggregations and resilience) in the same way that Port Joli meets the EBSA criteria (Doherty and Horsman 2007). Most of the inlet was identified three times by scientific experts but the centre of the inlet which is predominately intertidal was identified four times in the EBSA identification process (*Ibid.*). Port l'Hebert was originally classified as a Type I site and was later classified as a Type II site due to the predominant intertidal nature of the inlet.

Port l'Hebert is ecologically similar to Port Joli, as noted in the EBSA identification process (Doherty and Horsman 2007), however, less is known of the marine ecology of Port l'Hebert.

Extensive eelgrass beds and salt marshes (NSDNR 2000; Doherty and Horsman 2007; SCCRMP 1993; Environment Canada 2004) provide refuge and foraging areas not only for the bird species listed above, but also for marine species. They are also important primary producers in the coastal ecosystem. Additional sources of primary production are extensive kelp at the mouth of the inlet and rockweed in intertidal areas (SCCRMP 1993; Moore and Miller 1983). An abundance of urchins was noted in the area during dive transects in the 1980s (Moore and Miller 1983).

The extensive eelgrass is a potential nursery area as juvenile fish species are thought to associate with this habitat type (Heck *et al.* 2003). There are also lobsters in the area in high concentrations which are potentially reproducing (Doherty and Horsman 2007). Little subtidal information is available for this area, however, the study area is predominately intertidal.

In the EBSA workshop in 2006 Port l'Hebert was determined to have a medium degree of naturalness (Doherty and Horsman 2007).

Bird Information

Port l'Hebert is well-known as an important area for migratory bird species, especially Canada Goose, as it supports 30-40% of Atlantic Canada's overwintering population (Environment Canada 2004). This site and the Port Joli-Kejimkujik Seaside Adjunct site is fully encompassed within the boundaries of the much larger South Shore (Port Joli sector) IBA (Number NS004). In addition to its importance as a spring and fall migration stopover location for continentally significant numbers of Canada Goose (BLI 2009), the area has been known to host continentally significant numbers of wintering Harlequin Duck (special concern, SARA; CWS). Nationally significant numbers of migrating shorebird species, including Semipalmated Sandpiper, Willet, Least Sandpiper and Pectoral Sandpiper have been observed at this site. Colonies of Double-crested Cormorant, Great Black-backed Gull, Great Blue Heron, Common Eider, and both Common and Arctic Terns are also located here. The area as a whole hosts very high numbers of geese and dabbling ducks, possibly due to very high eelgrass densities, and also very high numbers of bay ducks and sea ducks.

Important Marine Ecological Features:

- Extensive eelgrass beds and salt marshes
- Extensive kelp and rockweed
- Lobsters are potentially reproducing
- SARA-listed species: Harlequin Duck (special concern)
- Birds: IBA (1), shorebirds, important area for migratory birds, eelgrass, geese, dabbling ducks, bay ducks, sea ducks

Human Uses and Impacts

There are few impacts to Port l'Hebert. Residential development, aquaculture, and marine plant harvesting are the only human uses and occur at small scales.

Coastal Development

Although the area is relatively undeveloped, it could be affected by increasing coastal development, primarily residential development, although this is less apparent than in Port Joli. The study area does not have a comprehensive municipal planning strategy or land use bylaws, which is also the case for the surrounding areas (see Appendix D) (CBCL Limited 2009).

Commercial Fishing

The only commercial fishery in the area is for lobster, with minimal landings. In grid square 308, the reporting unit that most closely aligns with the study area, 2008 lobster landings are estimated at 133 MT. These landings comprise 0.45% of 2008 landings in DFO's Maritimes Region and 4.30% of LFA 33 landings in 2008. LFA 33 comprises 10% of 2008 landings in the Maritimes Region (VDC 2009). There is one Small Craft Harbour in the area (CCN 2006), however most lobster harvesters from Port l'Hebert fish in Port Joli (B. Bowers, pers. comm. 2009). It is unlikely that there is any fishing in the immediate study area, due to its very shallow depth.

There were low landings of scallops just outside the mouth of the inlet (outside the study area) from 1999-2003 (DFO 2005a), but none are shown for 2007-2008 (VDC 2009). Table 4.25 below provides a summary of the only recent commercial fishery in the Port l'Hebert study area.

Table 4.25 Summary of Major Commercial Fisheries and Gear Used in the Port l'Hebert Study Area

Species	Landings*	Gear	Year	Source
Lobster	L	Trap	2008	VDC 2009

*H = high, M = medium, L = low

Aquaculture

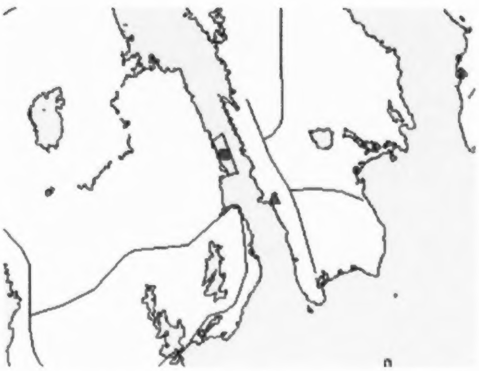


Figure 4.46 Aquaculture Licenses/Leases in Port l'Hebert (denoted by green squares) (Service Nova Scotia 2008)

Port l'Hebert has two aquaculture licenses (see Figure 4.46), although they may not be active as they have not been sampled under the EMP (Service Nova Scotia 2008; NSDFA 2006). There is one land-based site for soft-shell clams, Rainbow Trout and Atlantic salmon and a marine-based site for American and European oysters, blue mussels, and sea scallops (Service Nova Scotia 2008). The total aquaculture footprint is 0.29 km^2 or 2.9% of the total study area.

Marine Plant Harvesting

Port l'Hebert is leased for rockweed harvesting (Justin Huston, Nova Scotia Fisheries and Aquaculture, per. comm. 2009), although harvested quantities are minor compared to other areas in Nova Scotia. It is unknown if Irish moss harvesting occurs in Port l'Hebert, however, due to increasing demand, a decline in Irish moss landings and changes in stand composition in Lobster Bay, areas further east are being explored for harvesting potential (Sharp *et al.* 2008).

Tourism, Recreation, and Culture

Although there are no hotels, restaurants, or recreational outfitters in the immediate area, there are outdoor recreational opportunities including kayaking and hiking.

Current Protection and Research/Conservation Initiatives

The MBS in Port l'Hebert is the only form of terrestrial/marine protection in the inlet and the majority of the surrounding lands are privately owned (Service Nova Scotia 2006).

There are no current research initiatives known to be occurring in Port l'Hebert.

Summary

Table 4.26 below summarizes the key information provided in the site profile. Although lobsters are potentially reproducing in the area, more information is needed to confirm this. As there is minimal lobster fishing in Port l'Hebert, it is doubtful that lobsters are abundant. The area likely only meets one of the *Oceans Act* criteria for MPA establishment as it has extensive eelgrass beds which provide high primary productivity. Very little is known about Port l'Hebert and its primary ecological significance is that it provides important habitat for migratory birds.

Table 4.26 Summary of the Port l'Hebert Site Profile

***Oceans Act* Criteria (s.35)**	**Ecological Attributes**	**Human Uses**	**Current Protection and Research Initiatives**
(d) The conservation and protection of marine areas of high biodiversity or biological productivity	• Extensive eelgrass beds and salt marshes • Extensive kelp and rockweed • Lobsters are potentially reproducing • SARA species: Piping Plovers and Harlequin Duck • Birds: IBA (1), shorebirds, important area for migratory birds, eelgrass habitat, geese, dabbling ducks, bay ducks, sea ducks	• Fishing - lobster - crab • Potential rockweed and Irish moss harvesting • Aquaculture: finfish and shellfish • Potential for recreation activities • Residential development	• Current protection includes a MBS • No known research occurring at present

4.14 Cole Harbour

The Cole Harbour estuary is well-known as a recreational area often used by locals as it is located near the urban centres of Halifax and Dartmouth. The ecological significance of Cole Harbour is mostly within the intertidal area, where extensive salt marshes attract abundant waterfowl and shorebirds. The marine environment of Cole Harbour contains abundant eelgrass which may serve as an important nursery area for juvenile fish. Atlantic cod and salmon formerly spawned in the area and bluefin tuna forage outside the estuary in the summer months. There is also some evidence of diverse and dense stands of kelp. Population growth and increasing residential development are occurring in this area.

Location and Population

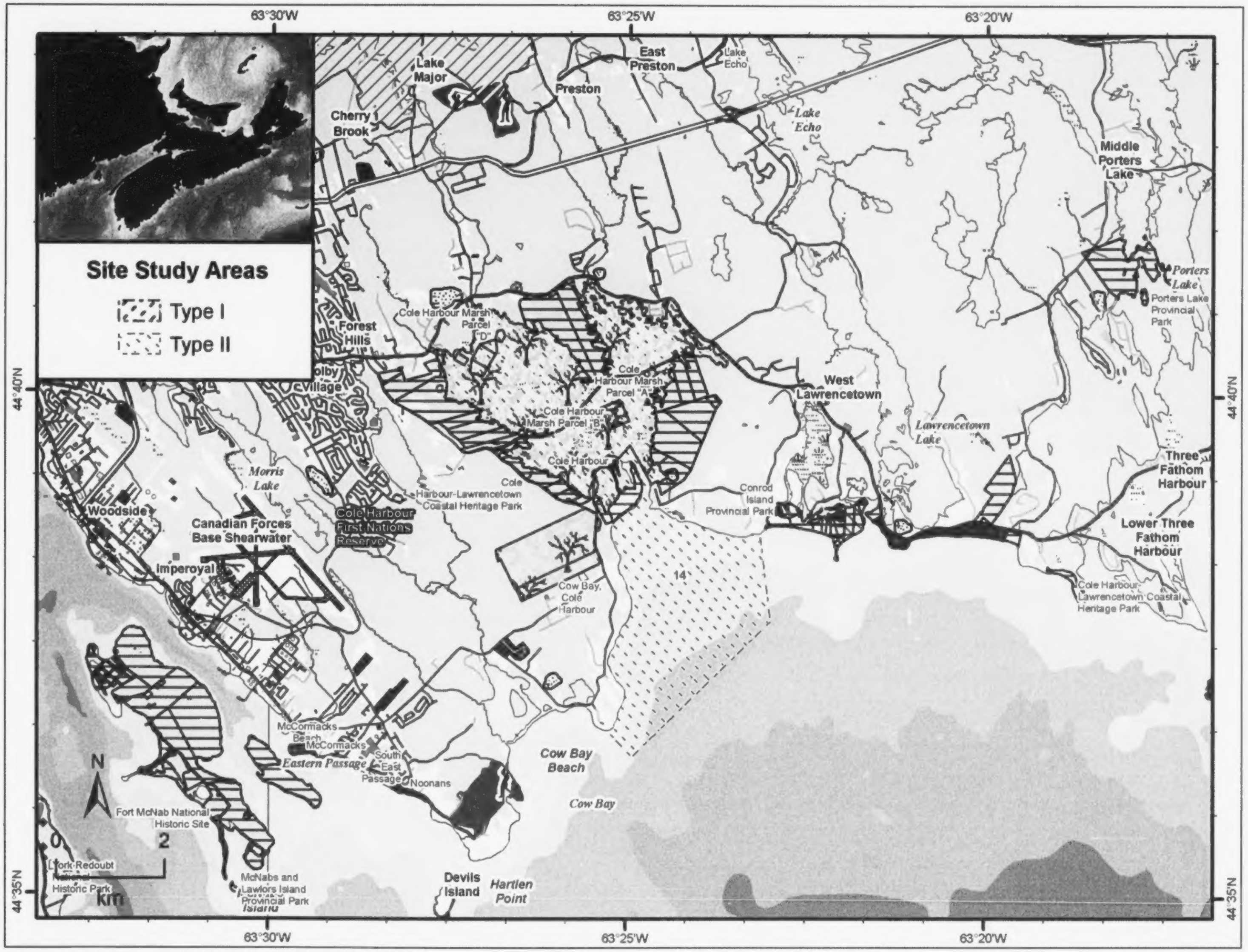
Cole Harbour is located in Halifax Regional Municipality (HRM) near the largest urban centre in Atlantic Canada, Halifax and Dartmouth, and is adjacent to the suburban area of Cole Harbour. The study area is 18.7 km^2 and comprises the entire estuary, extending seaward approximately four km from Rainbow Haven beach. See Figure 4.47 for a location map of Cole Harbour. The entire Cole Harbour estuary is a designated Provincial Park called the Cole Harbour – Lawrencetown Coastal Heritage Provincial Park and has a very high population density of over 140 people per km^2 (Municipal Services 2001). The highest density is near the northwest corner of the harbour. Cole Harbour has a population of 25,934 and is experiencing population growth (Service Nova Scotia 2006).

Physical and Oceanographic Attributes

Cole Harbour is an estuary with a delta formation and has a total coastal watershed area of approximately 88 km^2 (Fenton 1993). The study area is predominately intertidal. The seaward portion of the study area has a maximum depth of 20 m (CHS Charts 4012, 4237). Cole Harbour is classified as a Complex Mixed Bay (Greenlaw 2009).

Cole Harbour exhibits similar physical and oceanographic characteristics to the Chezzetcook to Jeddore Harbour area. Davis and Browne (1996b) describe the eastern shore as a highly indented and drowned coastline with long inlets, headlands, and several drumlin islands and landscapes which are concentrated in Cole Harbour and Lawrencetown. Sediment is actively transported causing the formation of sand spits and barrier beaches. The development of spits and barrier beaches shelters the inlet from the open ocean and allows for the development of several extensive salt marshes which are characteristic of the area. The mix of coastal habitats is similar to that of the LaHave drumlins area (Davis and Browne 1996b). See Figure 4.48 for an illustration of the many sensitive features in the area.

There are numerous dunes, beaches, estuarine flats (a total of 19 with a combined area of 627 ha), marine flats, lagoons (McCullough *et al.* 2005) and several small islands (NSDNR 2009a). Rainbow Haven is a sand spit with an extensive dune system that shelters the Cole Harbour estuary from the open ocean (McCullough *et al.* 2005) and is currently accreting sediment at a rapid rate (Davis and Browne 1996a). The area is highly sensitive to sea level rise (NRCan 2007).


63°30'W
63°25'W
63°20'W
44°40'N
44°35'N
Site Study Areas
Type I
Type II
Lake Major
Cherry Brook
East Preston
Preston
Lake Echo
Middle Porters Lake
Porters Lake
Porters Lake Provincial Park
Forest Hills
Cole Harbour Marsh Parcel "D"
Colby Village
Cole Harbour Marsh Parcel "A"
Cole Harbour Marsh Parcel "B"
Cole Harbour
West Lawrencetown
Lawrencetown Lake
Three Fathom Harbour
Lower Three Fathom Harbour
Morris Lake
Cole Harbour-Lawrencetown Coastal Heritage Park
Conrod Island Provincial Park
Woodside
Canadian Forces Base Shearwater
Cole Harbour First Nations Reserve
Imperoyal
Cow Bay, Cole Harbour
14
Cole Harbour-Lawrencetown Coastal Heritage Park
McCormacks Beach
McCormacks
Eastern Passage
South East Passage
Noonans
Cow Bay Beach
Cow Bay
Fort McNab National Historic Site
York Redoubt National Historic Park
McNabs and Lawlors Island Provincial Park
Devils Island
Hartlen Point
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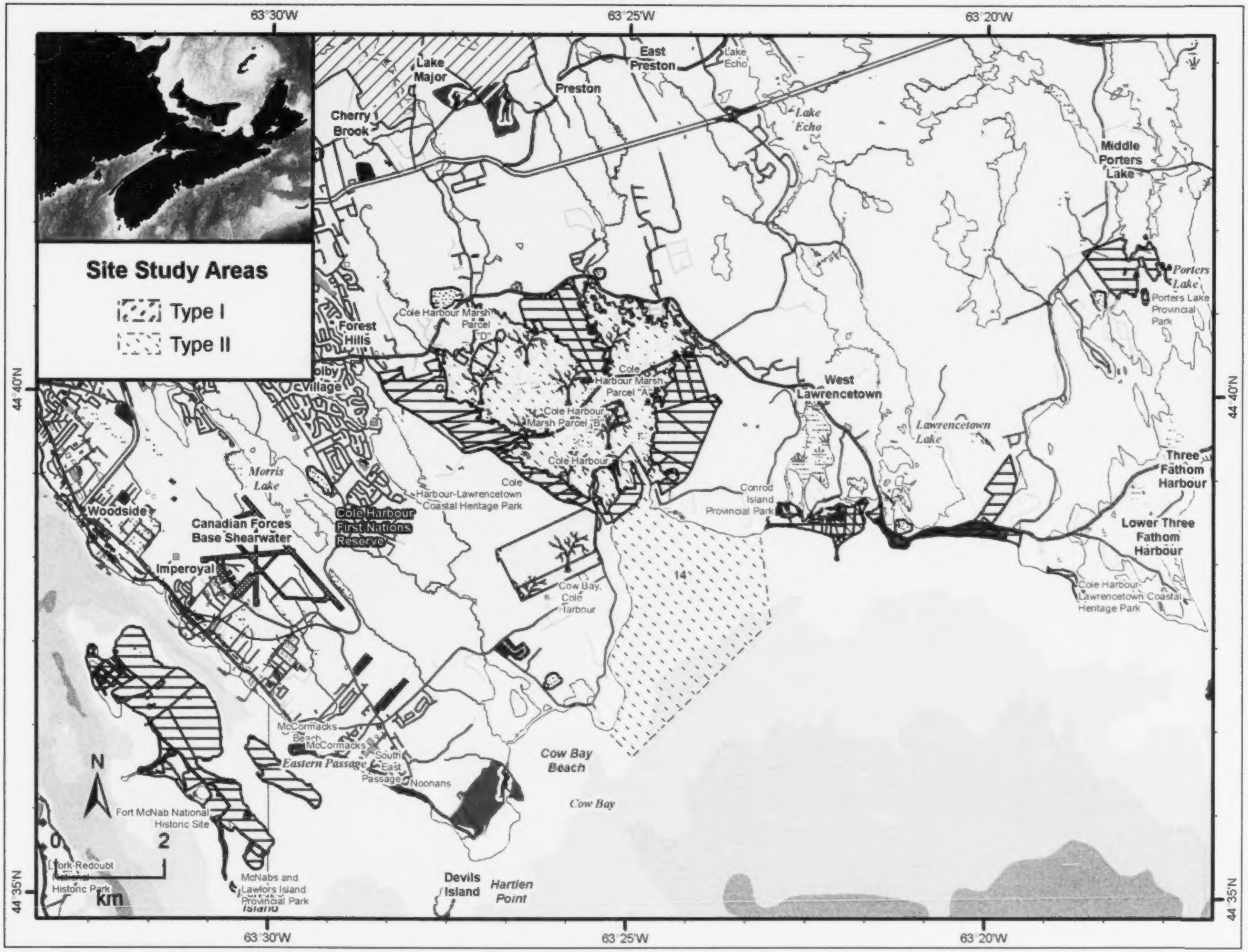
0
2
km

Figure 4.47 Location Map for Cole Harbour (Site #14). Basemap layers: land 1: 50 000, 1: 250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); Restricted and Limited Use Land Database Layers (NSDNR 2006b). Refer to Figure 4.1 for legend.


63°30'W
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63°20'W
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44°35'N
Site Study Areas
Type I
Type II
Lake Major
East Preston
Preston
Lake Echo
Cherry Brook
Middle Porters Lake
Porters Lake
Porters Lake Provincial Park
Forest Hills
Cole Harbour Marsh Parcel "D"
Cole Harbour Marsh Parcel "A"
Cole Harbour Marsh Parcel "B"
Cole Harbour
Cole Harbour-Lawrencetown Coastal Heritage Park
Colby Village
West Lawrencetown
Lawrencetown Lake
Three Fathom Harbour
Lower Three Fathom Harbour
Conrod Island Provincial Park
Morris Lake
Woodside
Canadian Forces Base Shearwater
Cole Harbour First Nations Reserve
Imperoyal
14
Cow Bay, Cole Harbour
McCormacks Beach
McCormacks
Eastern Passage
South East Passage
Noonans
Cow Bay Beach
Cow Bay
Fort McNab National Historic Site
York Redoubt National Historic Park
McNabs and Lawlors Island Provincial Park
Devils Island
Hartlen Point
N
0
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km

Figure 4.47 Location Map for Cole Harbour (Site #14). Basemap layers: land 1: 50 000, 1: 250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); Restricted and Limited Use Land Database Layers (NSDNR 2006b). Refer to Figure 4.1 for legend.

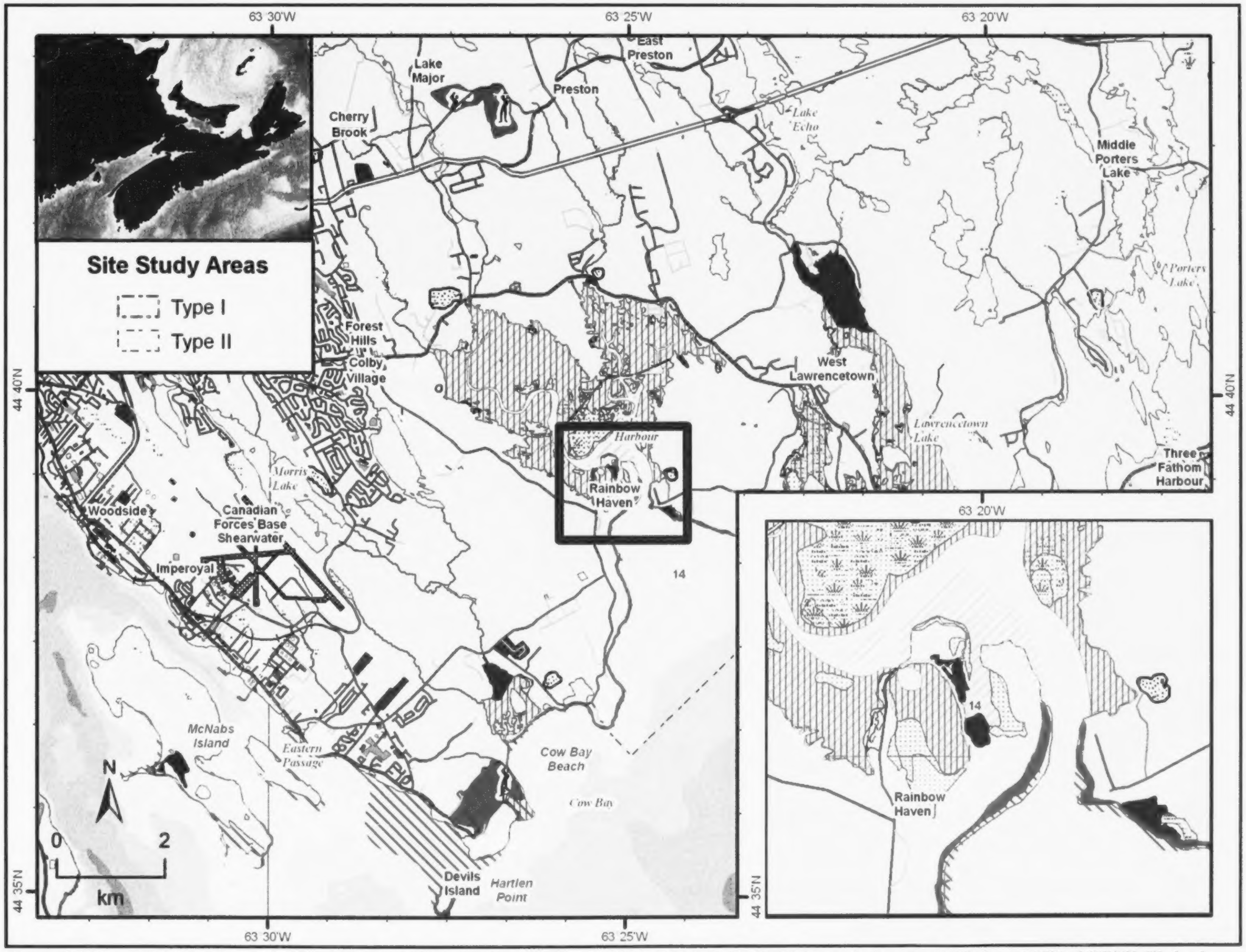
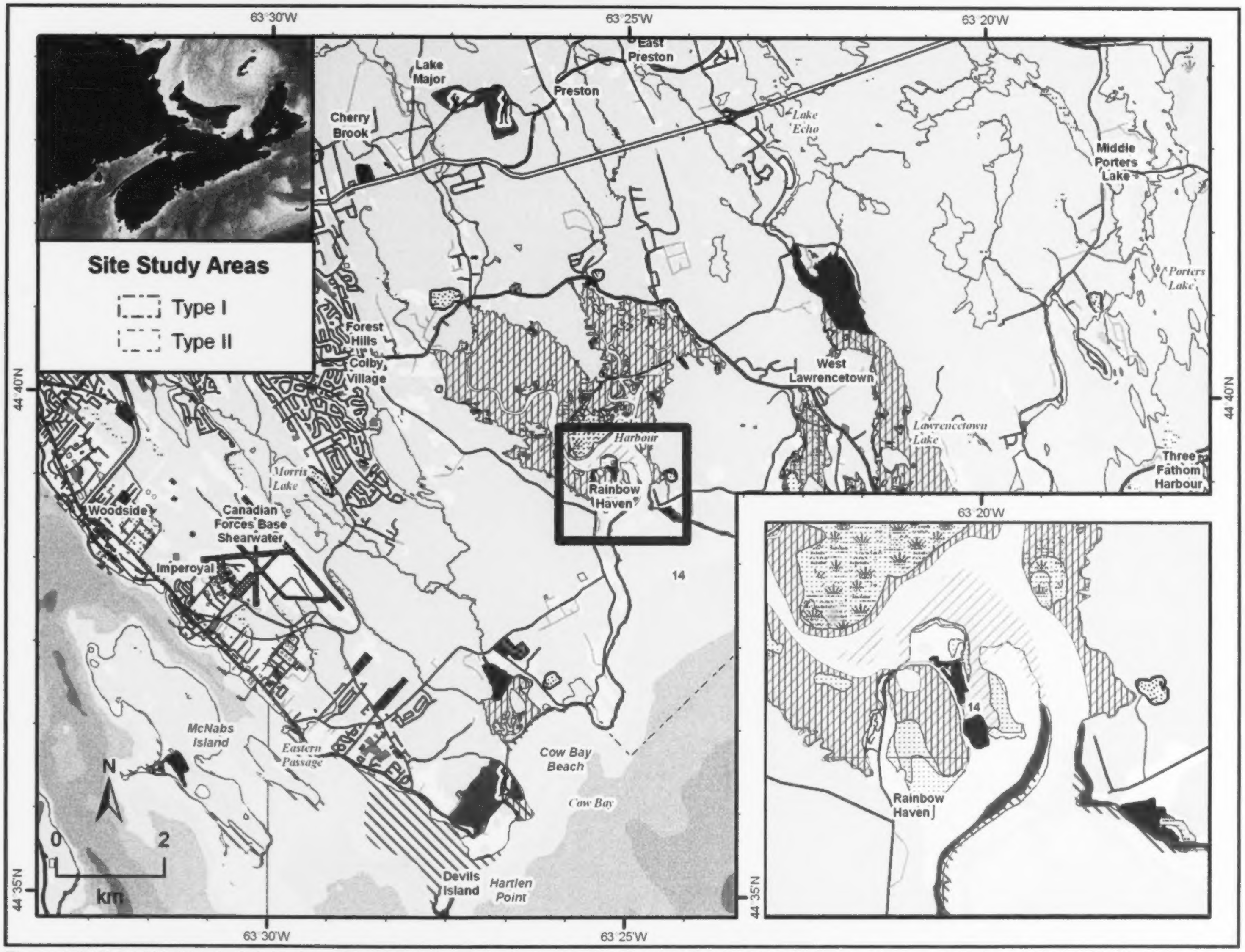

63 30'W
63 25'W
63 20'W
East Preston
Lake Major
Preston
Cherry Brook
Lake Echo
Middle Porters Lake
Site Study Areas
Type I
Type II
Porters Lake
Forest Hills
Colby Village
West Lawrencetown
44 40'N
Harbour
Rainbow Haven
Lawrencetown Lake
Three Fathom Harbour
Morris Lake
Woodside
Canadian Forces Base Shearwater
Imperoyal
14
McNabs Island
Eastern Passage
Cow Bay Beach
Cow Bay
N
0
2
km
Devils Island
Hartlen Point
44 35'N

Figure 4.48 Coastal Habitats in Cole Harbour (Site #14). Basemap layers: land 1:50 000, 1:250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); NSDNR Wetlands Database layers (NSDNR 2000). Refer to Figure 4.2 for legend.


63°30'W
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44°35'N
Site Study Areas
Type I
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Lake Major
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Cherry Brook
Lake Echo
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Porters Lake
Forest Hills
Colby Village
West Lawrencetown
Lawrencetown Lake
Three Fathom Harbour
Harbour
Rainbow Haven
Morris Lake
Woodside
Canadian Forces Base Shearwater
Imperoyal
14
McNabs Island
Eastern Passage
Cow Bay Beach
Cow Bay
Devils Island
Hartlen Point
N
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Figure 4.48 Coastal Habitats in Cole Harbour (Site #14). Basemap layers: land 1:50 000, 1:250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); NSDNR Wetlands Database layers (NSDNR 2000). Refer to Figure 4.2 for legend.

Ecological Attributes

Cole Harbour and the surrounding area were identified by scientific experts as an EBSA. It meets the three primary EBSA criteria: uniqueness, aggregations and fitness consequences, to an unspecified degree (Doherty and Horsman 2007). The inner harbour area was identified three times by scientific experts and the outer harbour was identified two times in the EBSA identification process (Doherty and Horsman 2007). The intertidal nature of Cole Harbour has resulted in the classification of this site as a Type II site. Otherwise, it would have been classified as a Type I site for its high ecological significance.

The estuary is highly productive and is relatively intact despite the high population density of the nearby urban centre of Halifax and Dartmouth. There are extensive eelgrass beds and high and low salt marshes that span an area of 93 ha (McCullough *et al.* 2005). Eelgrass declined by approximately 49% between 1992 and 2002, however, this is less than other inlets studied on the Eastern Shore (Chapman and Smith 2006 *In* DFO 2006a).

Cole Harbour is also important for marine species. The offshore area was a known spawning area for cod in 1982-85 (Trippel 2002 *In* McCullough *et al.* 2005) and it was once a salmon spawning area (McCullough *et al.* 2005), however, it is unlikely that salmon currently spawn in the area (DFO 2008e). Bluefin tuna forage outside of the estuary in the summer months and there is an abundance of blue crabs and soft-shell clams within the estuary. There is also some lobster bottom outside of the estuary (McCullough *et al.* 2005; Doherty and Horsman 2007). It was also noted that urchins are recovering from their mass die-off of the 1980s (R. Miller, pers. comm. *In* Bundy *et al.* 2007).

The marine waters outside of the Cole Harbour estuary contain herring spawning grounds. This area is one of only four current herring spawning areas within the scope of this report and one of seven areas along the Atlantic coast of Nova Scotia and in the Bay of Fundy (DFO 2008a).

Although the current diversity and abundance of marine plants in the area is unknown, dive transects done by Moore and Miller (1983) showed that marine plant species in Cow Bay were dense and diverse but more sparsely distributed and less diverse in Lawrencetown.

The naturalness of the estuary is likely affected by high levels of residential development. The EBSA naturalness criterion was not met in the 2006 EBSA workshop (Doherty and Horsman 2007).

Bird Information

This area does not coincide or otherwise overlap with presently identified IBAs. A single small colony hosting Common Terns, Great Black-backed Gulls, and Herring Gulls is located in this area. The site however is known as a Piping Plover (endangered, SARA; CWS) breeding area. High numbers of shorebirds are known to occur here during migration. Among these, Red Knot (*rufa* spp.; endangered, COSEWIC; CWS) have been observed at the site. Eelgrass densities also have been assessed as being very high; hence geese and dabbling ducks occur here in very high numbers. High to very high counts of bay ducks and sea ducks also have been recorded here (CWS).

Important Marine Ecological Features:

- Potential spawning area for Atlantic cod and Atlantic salmon
- Herring spawning area in offshore area adjacent to study area
- Bluefin tuna foraging area in offshore area adjacent to study area
- Abundance of blue crabs and soft-shell clams
- Extensive salt marshes and eelgrass beds
- SARA-listed species: Piping Plover (endangered)
- COSEWIC-assessed species: Atlantic cod (endangered) and Red Knot (*rufa* spp.; endangered)
- Birds: species at risk, shorebirds, eelgrass habitat, geese, dabbling ducks, sea ducks

Human Uses

Human uses in the area include land-based activities associated with high levels of residential development, fishing, and recreation.

Coastal Development

Salt marshes and eelgrass beds are highly sensitive to coastal development. Cole Harbour has been an urban centre for many years and has been impacted by humans for centuries (Davis and Browne 1996b). Eelgrass declined 49% between 1992 and 2002, however it experienced the lowest decline of three adjacent inlets that were also studied (Chapman and Smith 2006 *In* DFO 2006a). This is surprising given that Cole Harbour has the most residential and commercial development compared to the other three inlets. This may imply a higher than average resiliency or perhaps it is explained by the protected status of the surrounding watershed under Nova Scotia Environment's *Environment Act*. Also, Halifax Regional Municipality has a comprehensive municipal planning strategy and associated land use bylaws (see Appendix D) (CBCL Limited 2009).

There is some concern that increasing recreational activities may be compromising the ecological integrity of the area (McCullough *et al.* 2005).

Commercial Fishing

Fisheries in Cole Harbour and outside the harbour are minimal compared to other areas in this analysis. The primary fishery is herring, which makes up 99% of landings other than lobster from 2007-2008 (VDC 2009). A bluefin tuna fishery occurred from 1999-2003 with a medium level of landings (DFO 2005a), however, this took place outside of the study area further from shore. Current data do not show tuna fishing near the study area (VDC 2009). Scallop fishing also occurred at low levels adjacent to the area from 1999-2003 (DFO 2005a).

The lobster fishery in this area is of low importance at the provincial scale. In grid squares 332 and 333, the reporting units that most closely align with the study area, 2008 lobster landings are estimated at 265 MT. These landings comprise 0.89% of 2008 landings in DFO's Maritimes Region and 6.94% of LFA 32 and LFA 33 landings in 2008 (the grid squares are located in LFA 32 and 33) (VDC 2009).

The soft-shell clam fishery in Cole Harbour is an important fishery on the Eastern Shore, although there have been indications of lower stock abundance in recent years (M. Butler, Fisheries and Aquaculture Management Branch, pers. comm. 2010). There have been no landings in Cole Harbour since 2005 (CDD 2010). Most of the estuary is open for shellfish harvesting, with large closed areas in the most inshore areas and near Rainbow Haven.

There are no fish processing plants, boat building facilities, or wharves in the area. Eastern Passage is the closest Small Craft Harbour (CCN 2006). Table 4.27 below summarizes commercial fisheries in Cole Harbour.

Table 4.27 Summary of Major Commercial Fisheries and Gear Used in and Adjacent to the Cole Harbour Area

Species	Landings*	Gear	Year	Source
Herring	L	Mid-water gillnet	1999-2003 2007-2009	DFO 2005a VDC 2009
Lobster	L	Trap	2008	VDC 2009

*H = high, M = medium, L = low

Tourism, Recreation, and Culture

The Cole Harbour area is a common destination for locals who enjoy the beaches, bird watching, hiking through the salt marsh trail, hunting, surfing, kayaking and canoeing, and recreational fishing and clam-digging (NSDNR 2009a; McCullough *et al.* 2005). Popular recreation areas include Rainbow Haven Beach Provincial Park and the Cole Harbour – Lawrencetown Coastal Heritage Provincial Park which contains the winding Salt Marsh Trail (McCullough *et al.* 2005). The Cole Harbour First Nation reserve, located near the study area, is a satellite reserve of the Millbrook First Nation which is located in Truro (Mi'kmaq Resource Centre 2010).

Current Protection and Research/Conservation Initiatives

There are numerous adjacent coastal protected areas which could complement measures for marine protection. These areas include:

- Cole Harbour – Lawrencetown Coastal Heritage Provincial Park (designated in 1998); this is a very large area
- The Peter-McNab-Khun conservation area is a proposed WMA and will be surrounded by this provincial park. It will contain intertidal areas and the WMA will have an area of 970 ha (9.7 km^2) (NSDNR 2009a)
- EHJV Lands are located around and within the Provincial Park
- Conrad Island Provincial Park – east of estuary
- Rainbow Haven Beach Provincial Park – west of estuary

(NSDNR 2006b; Service Nova Scotia 2006)

The Cole Harbour estuary has been the subject of several research initiatives in the past, however, there are no current initiatives relevant to MPA planning. The potential designation of the area as a WMA may provoke further research.

Summary

Table 4.28 below summarizes the key information provided in the site profile. The Cole Harbour Estuary is predominantly intertidal containing extensive eelgrass beds and salt marshes which provide important habitat for migratory birds. There is also an abundance of invertebrates. The ecological attributes align with three of the *Oceans Act* criteria for MPA establishment. This area has the highest level of surrounding coastal development.

Table 4.28 Summary of the Cole Harbour Site Profile

***Oceans Act* Criteria (s.35)**	**Ecological Attributes**	**Human Uses**	**Current Protection and Research Initiatives**
(a) The conservation and protection of commercial and non-commercial fishery resources, including marine mammals, and their habitats; (b) The conservation and protection of endangered or threatened marine species, and their habitats (d) The conservation and protection of marine areas of high biodiversity or biological productivity	• Potential spawning area for Atlantic cod and salmon (offshore adjacent to study area) • Bluefin tuna foraging area (offshore adjacent to study area) • Herring spawning area offshore • Abundance of blue crabs and soft-shell clams • Extensive salt marshes and eelgrass beds • SARA species: Piping Plover • COSEWIC species: Atlantic cod and Red Knot • Birds: species at risk, eelgrass habitat, geese, dabbling ducks, sea ducks	• Fishing - herring - lobster - soft-shell clams • Very high levels of commercial and residential coastal development • High levels of recreational use	• Proposed WMA • Several other protected areas within and surrounding the area • No current research initiatives relevant for conservation planning • Current marine data are lacking

4.15 Chezzetcook to Jeddore Harbour

The Chezzetcook to Jeddore Harbour area is well known as an important area for waterfowl and shorebirds and has more Black Ducks and Canada geese than anywhere else in Nova Scotia. There are several salt and freshwater wetlands which are important habitat for birds, but may also serve as important nursery areas for marine species such as Atlantic cod, recently assessed as endangered by COSEWIC (COSEWIC 2010). The area is an important spawning area for haddock, herring, pollock, and Atlantic salmon, and contains an abundance of crabs. The area is in a relatively natural state with a very low population density, however, eelgrass and salt marsh declines indicate that growing residential development may be a major threat to the area.

Location and Population

The Chezzetcook to Jeddore Harbour area contains four inlets: Chezzetcook Inlet, Petpeswick Inlet, Musquodoboit Harbour, and Jeddore Harbour. The inlets extend from just outside the city of Dartmouth eastward to approximately the halfway point along the coast of Halifax County. The inlets are within Halifax Regional Municipality. There are few towns in the area, the largest of which is the rural town of Musquodoboit Harbour with a population of approximately 1,000. The population of Musquodoboit Harbour and the surrounding communities is growing (HRM 2009). The area has a low average population density of 10-20 people per km^2 (Municipal Services 2001). The delineated study area is 56.2 km^2 and comprises all four inlets, extending approximately three kilometres seaward. See Figure 4.50 for a location map of the Chezzetcook to Jeddore Harbour study area.

Physical and Oceanographic Attributes

The four inlets have a total area of approximately 74.6 km^2 (including intertidal areas) and a total coastline length of 185.2 km (DFO 2007d) (this does not include the seaward portion of the study area). Chezzetcook, Petpeswick, and Musquodoboit are primarily intertidal with maximum depths of 5 m in the mouth of the inlets. Jeddore Harbour is deeper, with maximum depths of 10 m in scattered areas of the harbour (see Figure 4.49, DFO 2007d). The seaward extent of the study area has a maximum depth of 36.6 m (CHS Charts 4012 and 4326). Chezzetcook, Petpeswick, Musquodoboit, and Jeddore have inlet classifications of Complex Benthic Bay, Intermediate Benthic Bay, Intermediate Benthic Estuary, and an Intermediate Mixed Estuary, respectively (Greenlaw 2009). The inlets have high flushing times ranging from 12.5 to 42.3 hours and have low tidal to freshwater ratios ranging from of 39.7:1 to 186.3:1, indicating a predominately estuarine environment with high freshwater input (DFO 2007d). The combined freshwater drainage area of all three inlets is 1141.3 km^2 with Musquodoboit having the largest drainage area of 765.3 km^2.

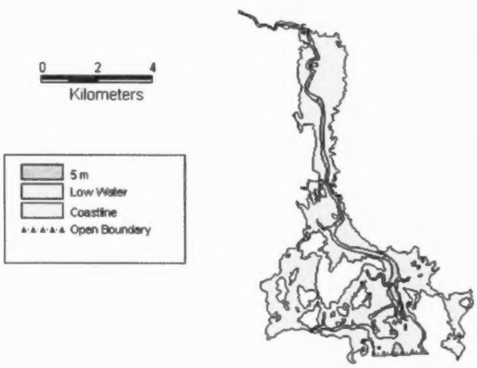


Figure 4.49 Musquodoboit Harbour Bathymetry (DFO 2007d) Coastline = intertidal zone

Davis and Browne (1996b) describe the physical properties and oceanographic properties of the Chezzetcook to Jeddore Harbour area. It exhibits typical physical and oceanographic properties of the eastern shore of Nova Scotia and has geology similar to Lobster Bay. The eastern shore is a highly indented and drowned coastline with long inlets, headlands, and drumlin islands, although drumlins in the study area are limited to

Chezzetcook Inlet. Sediment is actively transported causing the formation of sand spits and barrier beaches. These formations shelter the inlets from the open ocean and allow for the development of several extensive salt marshes which are characteristic of the area. The mix of coastal habitats is similar to that of the LaHave drumlins area. There are numerous dunes, beaches, estuarine and marine flats, and lagoons (McCullough *et al.* 2005). Many of these features are illustrated in Figure 4.51. The area is highly sensitive to sea level rise (NRCan 2007).

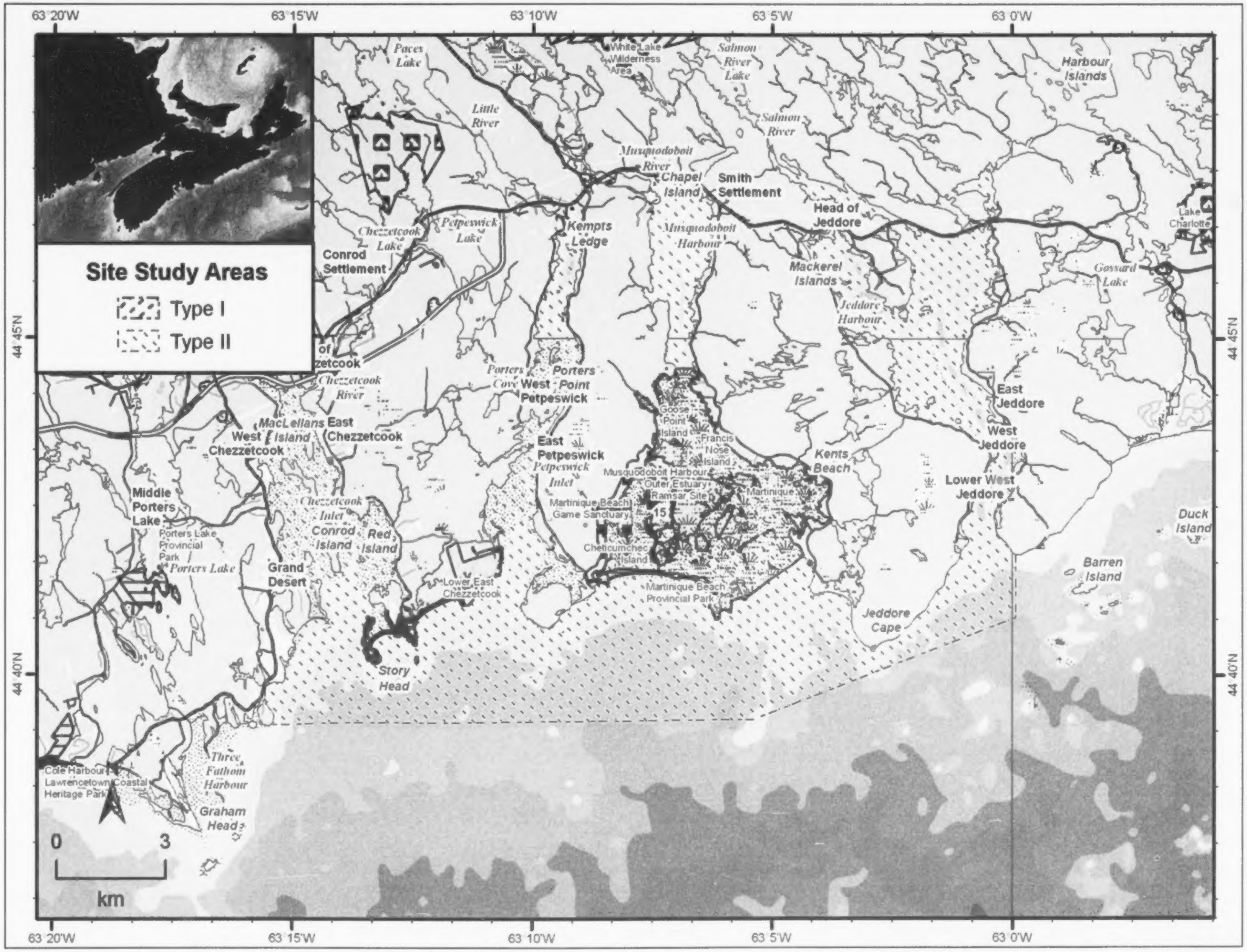

63°20'W
63°15'W
63°10'W
63°5'W
63°0'W
44°45'N
44°40'N
Site Study Areas
Type I
Type II
Paces Lake
White Lake Wilderness Area
Salmon River Lake
Harbour Islands
Little River
Salmon River
Musquodoboit River
Chapel Island
Smith Settlement
Head of Jeddore
Lake Charlotte
Chezzetcook Lake
Petpeswick Lake
Kempts Ledge
Musquodoboit Harbour
Conrod Settlement
Mackerel Islands
Gossard Lake
Jeddore Harbour
Chezzetcook River
Porters Cove
Porters Point
West Petpeswick
East Jeddore
MacLellans Island
West Chezzetcook
East Chezzetcook
East Petpeswick
Petpeswick Inlet
Goose Point Island
Francis Nose Island
Musquodoboit Harbour Outer Estuary Ramsar Site
Martinique
Kents Beach
West Jeddore
Lower West Jeddore
Martinique Beach Game Sanctuary
15
Middle Porters Lake
Porters Lake Provincial Park
Porters Lake
Chezzetcook Inlet
Conrod Island
Red Island
Grand Desert
Lower East Chezzetcook
Cheticumcheo Island
Martinique Beach Provincial Park
Duck Island
Barren Island
Jeddore Cape
Story Head
Three Fathom Harbour
Cole Harbour Lawrencetown Coastal Heritage Park
Graham Head
0
3
km

Figure 4.50 Location Map for Chezzetcook to Jeddore Harbour (Site #15). Basemap layers: land 1: 50 000, 1: 250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); Restricted and Limited Use Land Database Layers (NSDNR 2006b). Refer to Figure 4.1 for legend.

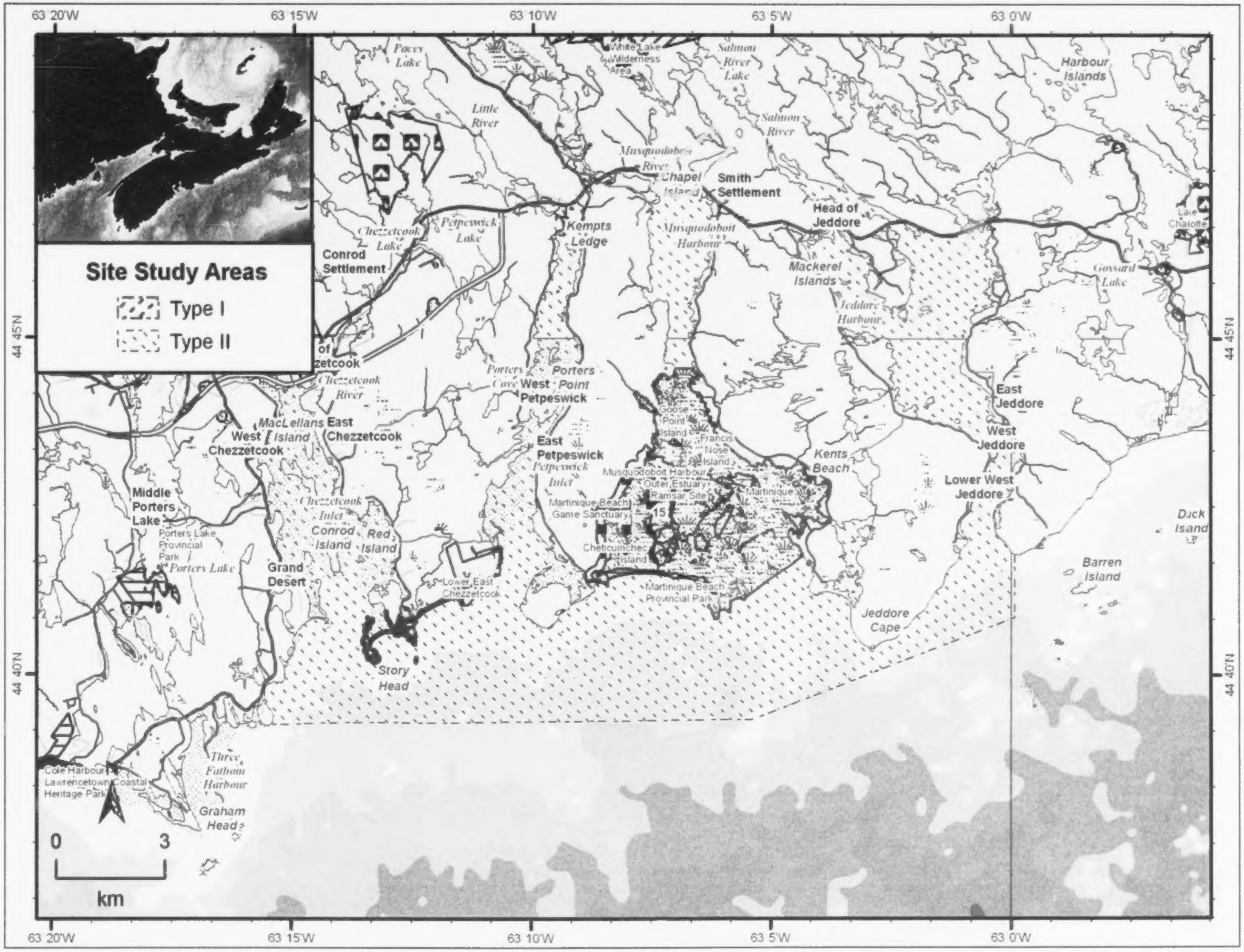

63 20'W
63 15'W
63 10'W
63 5'W
63 0'W
44 45'N
44 40'N
Site Study Areas
Type I
Type II
Pacey Lake
Little River
White Lake Wilderness Area
Salmon River Lake
Salmon River
Harbour Islands
Musquodoboit River
Chapel Island
Smith Settlement
Head of Jeddore
Kempts Ledge
Musquodoboit Harbour
Chezzetcook Lake
Petpeswick Lake
Conrod Settlement
Mackerel Islands
Jeddore Harbour
Gossard Lake
Lake Charlotte
Chezzetcook
Chezzetcook River
Porters Cove
West Petpeswick
Porters Point
East Jeddore
MacLellans Island
East Chezzetcook
West Chezzetcook
Goose Point Island
Francis Nose Island
East Petpeswick
Petpeswick Inlet
West Jeddore
Kents Beach
Musquodoboit Harbour Outer Estuary Ramsar Site
Martinique
Lower West Jeddore
Middle Porters Lake
Martinique Beach Game Sanctuary
15
Chezzetcook Inlet
Conrod Island
Red Island
Cheticumchee Island
Porters Lake Provincial Park
Porters Lake
Grand Desert
Lower East Chezzetcook
Martinique Beach Provincial Park
Duck Island
Barren Island
Jeddore Cape
Story Head
Three Fathom Harbour
Cole Harbour Lawrencetown Coastal Heritage Park
Graham Head
0
3
km

Figure 4.50 Location Map for Chezzetcook to Jeddore Harbour (Site #15). Basemap layers: land 1: 50 000, 1: 250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); Restricted and Limited Use Land Database Layers (NSDNR 2006b). Refer to Figure 4.1 for legend.

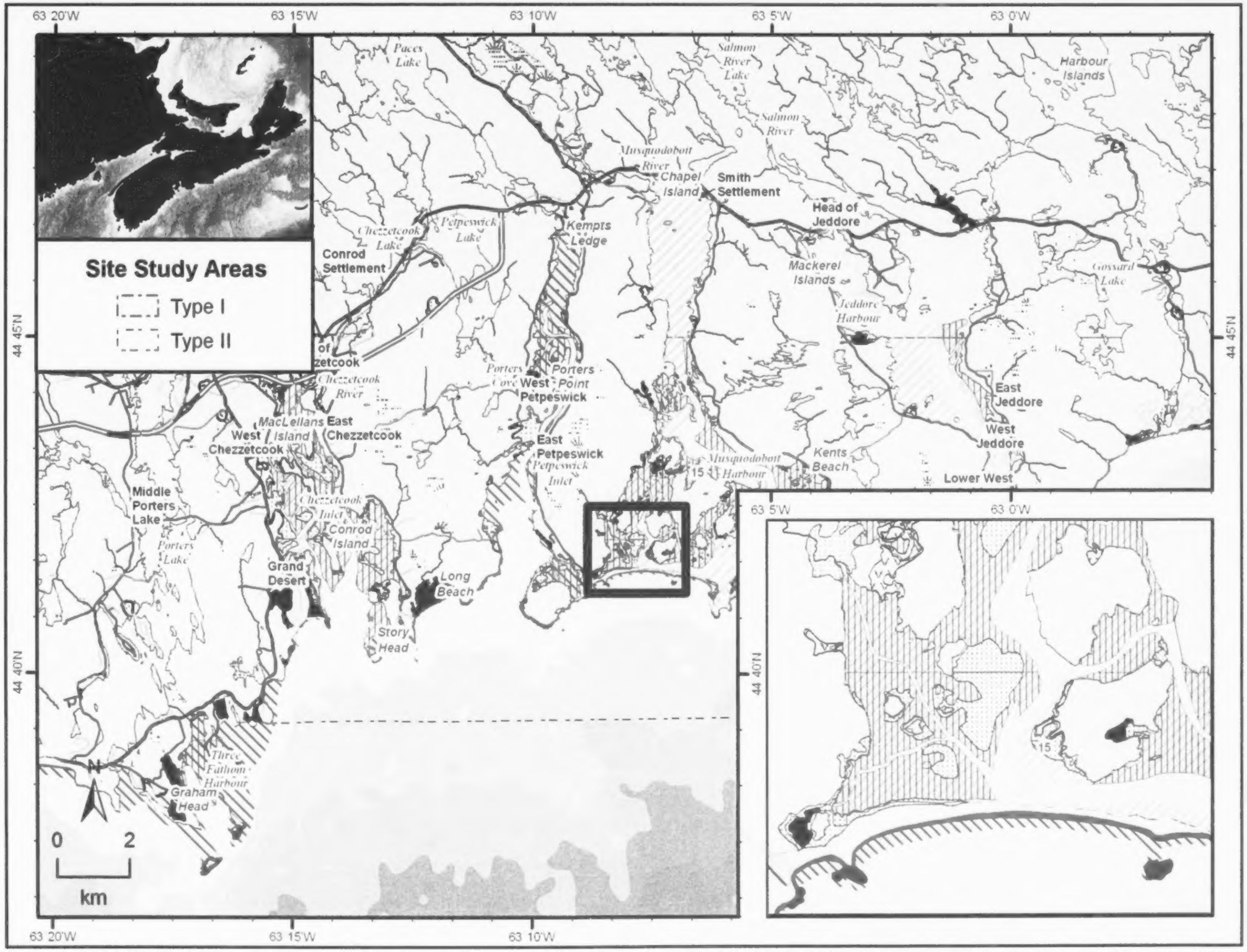
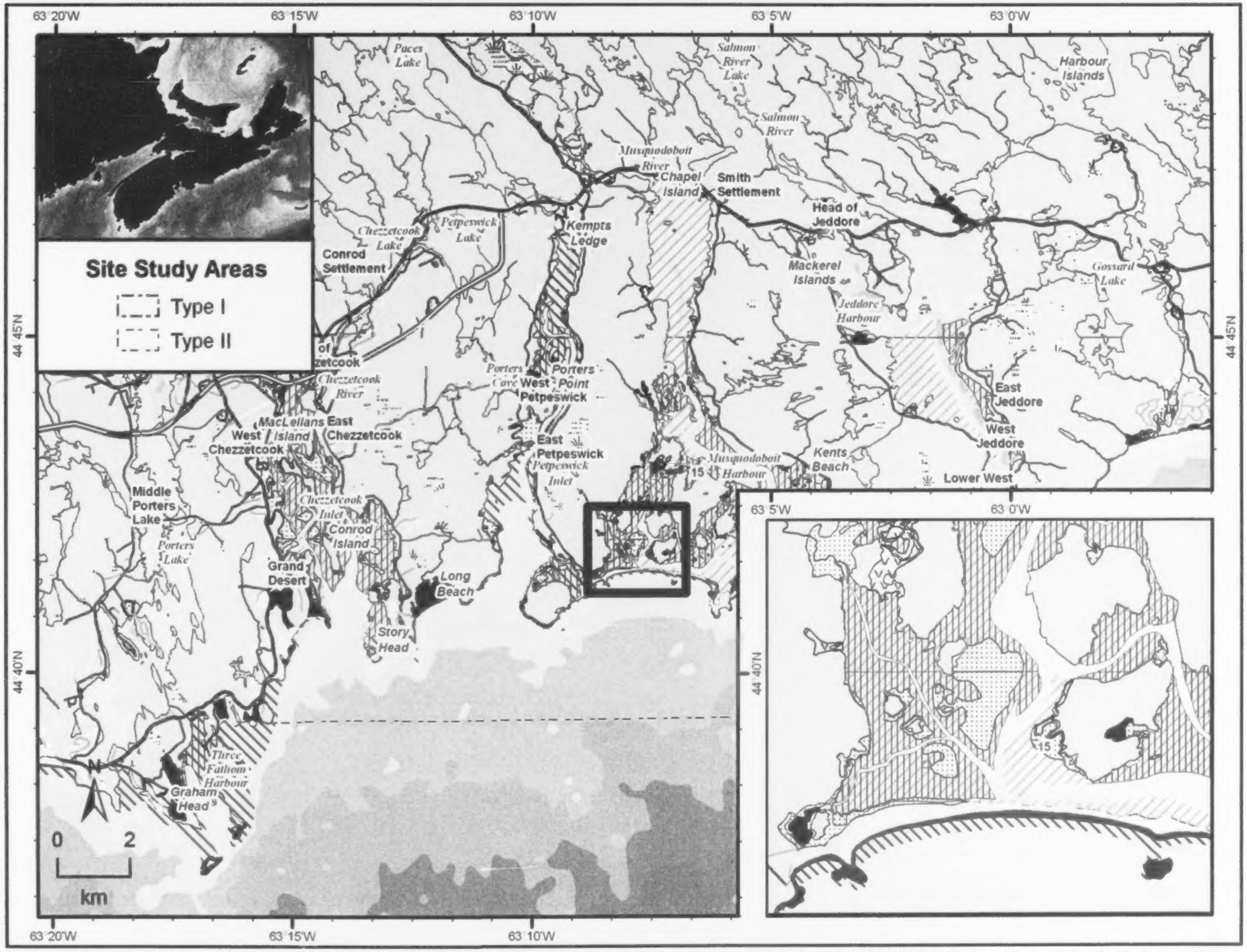

63 20'W
63 15'W
63 10'W
63 5'W
63 0'W
44 45'N
44 40'N
Site Study Areas
Type I
Type II
Paces Lake
Salmon River Lake
Salmon River
Harbour Islands
Musquodoboit River
Chapel Island
Smith Settlement
Head of Jeddore
Kempts Ledge
Chezzetcook Lake
Petpeswick Lake
Conrod Settlement
Mackerel Islands
Gossard Lake
Jeddore Harbour
Porters Cove
Porters Point
West Petpeswick
East Jeddore
West Jeddore
Chezzetcook River
MacLellans Island
East Chezzetcook
West Chezzetcook
East Petpeswick
Petpeswick Inlet
Musquodoboit Harbour
Kents Beach
Lower West
15
Middle Porters Lake
Porters Lake
Chezzetcook Inlet
Conrod Island
Grand Desert
Long Beach
Story Head
Three Fathom Harbour
Graham Head
N
0
2
km

Figure 4.51 Coastal Habitats from Chezzetcook to Jeddore Harbour (Site #15). Basemap layers: land 1:50 000, 1:250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); NSDNR Wetlands Database layers (NSDNR 2000). Refer to Figure 4.2 for legend.


63°20'W
63°15'W
63°10'W
63°5'W
63°0'W
44°45'N
44°40'N
Site Study Areas
Type I
Type II
Paces Lake
Salmon River Lake
Harbour Islands
Salmon River
Musquodoboit River
Chapel Island
Smith Settlement
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Kempts Ledge
Conrod Settlement
Mackerel Islands
Gossard Lake
Jeddore Harbour
Chezzetcook River
Porters Cove
West Petpeswick
Porters Point
East Jeddore
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MacLellans Island
East Chezzetcook
East Petpeswick
Petpeswick Inlet
West Jeddore
Musquodoboit Harbour
Kents Beach
Lower West
15
Middle Porters Lake
Chezzetcook Inlet
Conrod Island
Porters Lake
Grand Desert
Long Beach
Story Head
Three Fathom Harbour
Graham Head
N
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Figure 4.51 Coastal Habitats from Chezzetcook to Jeddore Harbour (Site #15). Basemap layers: land 1:50 000, 1:250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); NSDNR Wetlands Database layers (NSDNR 2000). Refer to Figure 4.2 for legend.

Ecological Attributes

The Chezzetcook to Jeddore Harbour area was identified by scientific experts as an EBSA. It meets all of the EBSA criteria from a low to high degree (it has high aggregations and high fitness consequences) (Doherty and Horsman 2007). The area was identified three to four times by scientific experts (although Jeddore Harbour was only identified twice) in the EBSA identification process whereas many other areas were only identified one or two times (Doherty and Horsman 2007). The intertidal nature of the Chezzetcook Inlet to Jeddore Harbour area has resulted in the classification of this site as a Type II site. Otherwise, it would have been classified as a Type I site for its high ecological significance.

Although this area is primarily recognized for its importance for waterfowl and shorebirds, with counts of black duck and Canada Goose higher than anywhere else in Nova Scotia (Davis and Browne 1996b), it is also important for marine species, which likely provide an important food source for migrating birds.

Several species spawn in and around the study area. Three Fathom Harbour is particularly important, with potential Atlantic cod and known pollock spawning taking place. Witch flounder and Atlantic salmon also use the study area and surrounding watershed as spawning grounds (Trippel 2002 *In* McCullough *et al.* 2005; Lane and Associates 1992), although the current spawning activity is unknown. In 2000, salmon spawning occurred at high densities in Jeddore Harbour (DFO 2008e).

The marine waters outside of the inlets within the study area contain herring spawning grounds. This area is one of only four current herring spawning areas within the scope of this report and one of seven areas along the coast of Nova Scotia and in the Bay of Fundy (DFO 2008a). The Little Hope Island area of Port Joli, the Bras d'Or Lakes, and Lobster Bay are also current herring spawning areas (*Ibid.*).

Musquodoboit Harbour is a potential haddock nursery area (Trippel 2002 *In* McCullough *et al.* 2005). Extensive eelgrass beds in all four inlets (NSDNR 2000; Doherty and Horsman 2007) may provide habitat for juvenile species. Extensive eelgrass beds and salt marshes make the Chezzetcook to Jeddore area highly productive, despite the recent declines in both habitat types (McCullough *et al.* 2005; Bundy *et al.* 2007; Doherty and Horsman 2007; Chapman and Smith 2006 *In* DFO 2006a). Eelgrass beds declined as much as 96% in Petpeswick Inlet between 1992 and 2002 (Chapman and Smith 2006 *In* DFO 2006a). Declines of over 49% occurred in Musquodoboit and Chezzetcook in the same timeframe (*Ibid.*). There are few marine plants such as kelp, in the inshore areas due to the muddy substrate type that better supports eelgrass and salt marshes, however, toward the mouth of the inlets there is a higher abundance and diversity of marine plant life (Moore and Miller 1983).

Other species are abundant, especially invertebrates. There are abundant and diverse invertebrates in the mud flats of Musquodoboit: lobster bottom is found just outside of the four inlets; abundant Jonah and rock crab are found in certain inlets; there are 12 important flats for soft-shell clams in Chezzetcook; and urchins are beginning to recover from the die-off (McCullough *et al.* 2005; Bundy *et al.* 2007).

The area met the secondary EBSA criteria for naturalness to a low degree (Doherty and Horsman 2007). Significant declines of eelgrass documented recently (Chapman and Smith 2006 *In* DFO 2006a) may indicate that the area is highly sensitive to coastal development. Although the area has a low population, land-based activities occur in the area. Surface water sensitivity to eutrophication ranges from low to high in Chezzetcook inlet during all seasons and bottom water sensitivity is high in

Jeddore and Musquodoboit Harbour in the fall (Yeats 2007 *In* DFO 2007c). Out of approximately twelve general areas sampled, five showed high surface water sensitivity to eutrophication.

Bird Information

This area fully encompasses the much smaller Musquodoboit IBA (Number NS014) known to host, on its own, continentally significant numbers of Canada Goose and American Black Duck during spring and fall migration periods, and also during winter (BLI 2009). Breeding Piping Plover (endangered, SARA; CWS) are found here. The area as a whole, stretching from Chezzetcook to Jeddore Harbour consistently hosts some of the highest numbers ever observed for Canada Goose in Atlantic Canada. Eelgrass densities at this site are very high. Bay duck numbers are typically high while sea ducks reach very high numbers, the latter species group being associated with more exposed areas off of Chezzetcook and Jeddore (CWS).

Important Marine Ecological Features:

- Spawning area: pollock, herring, witch flounder, and potentially Atlantic cod and Atlantic salmon (outside the inlets)
- Potential haddock nursery area
- Extensive salt marshes and eelgrass beds
- Abundance and diversity of invertebrates
- SARA-listed species: breeding Piping Plover (endangered)
- COSEWIC-assessed species: Atlantic cod (endangered)
- Birds: IBA (1), species at risk, eelgrass habitat, geese, dabbling ducks, sea ducks

Human Uses

The human uses in the Chezzetcook to Jeddore area are primarily land-based activities but fishing, aquaculture, and recreation also occur.

Coastal Development

The salt marshes and eelgrass beds in the Chezzetcook to Jeddore area are affected by coastal development and land-based activities, as indicated by major declines in eelgrass beds noted in the previous section. Although the area currently has a low population density, this is one of very few areas in Nova Scotia experiencing an increase in population (HRM 2009). Residential development could significantly accelerate the natural erosion rates and significantly impact wetlands (McCullough *et al.* 2005). Halifax Regional Municipality has a comprehensive municipal planning strategy and associated land use bylaws (see Appendix D) (CBCL Limited 2009); perhaps somewhat recent amendments including setbacks may alleviate some of the development pressure on these sensitive ecosystems.

There is an exploratory mineral license onshore near Petpeswick (Fisher and Wenning 2008). There was a plan to re-dredge East Chezzetcook Harbour at the time of writing (CEAA 2007).

Commercial Fishing

Fisheries that take place in and adjacent to the study area include groundfish (including some halibut), herring, crab (excluding snow crab), lobster, soft-shell clam, and sand and blood worm (VDC 2009; McCullough *et al.* 2005). Most of the fisheries in the study area take place outside of the inlets, starting from the mouths of the inlets and extending further offshore. The biggest fishery in the area is herring, making up 99% of landings (excluding data for lobster, soft-shell clam, blood and sand worm) (VDC 2009). Medium to high landings of crabs other than snow crab were caught inshore from 1999-2003 (DFO 2005a) but there were no landings from 2007-2009 (VDC 2009). From 1999-2003 there were low landings of bluefin tuna and mackerel (DFO 2005a), however no landings were recorded in 2007-2009 (VDC 2009). Groundfish (mainly Atlantic halibut) and lobster are caught in the area; both have low landings (DFO 2005a; VDC 2009).

The lobster fishery in this area is of low importance at the provincial scale. In grid squares 323, 324, and 325, the reporting units that most closely align with the study area, 2008 lobster landings are estimated at 140 MT. These landings comprise 0.47% of 2008 landings in DFO's Maritimes Region and 19.74% of LFA 32 landings in 2008. LFA 32 comprises 2.38% of 2008 landings in the Maritimes Region (VDC 2009).

The soft-shell clam fishery is a significant fishery in the area. In 1995 half of all harvesters in district 20 dug clams as their sole means of income (McCullough *et al.* 2005). Chezzetcook to Musquodoboit have some of the most important soft-shell clam harvesting sites in the province. Most harvesting occurred in Three-fathom Harbour in the 1980s (McCullough *et al.* 2005). An assessment by Moore *et al.* (2003) determined that the clam fishery in Chezzetcook Harbour has potential for enhancement by transplanting clams from a giving to a receiving area.

There is sand and blood worm harvesting at West Jeddore and Jeddore Harbour, but the extent is unknown (McCullough *et al.* 2005). There is also a smelt fishery in Jeddore and Musquodoboit using dipnets and spears (*Ibid.*), although landings and current activity are unknown.

There are two Small Craft Harbours, three community wharves, one of which is used for recreation, and 2 fish processing plants in the area (CCN 2006). Table 4.29 below summarizes commercial fishery landing and gear types in Chezzetcook to Jeddore Harbour.

Table 4.29 Summary of Major Commercial Fisheries and Gear Used from Chezzetcook to Jeddore Harbour and the Adjacent Area

Species	**Landings***	**Gear**	**Year**	**Source**
Groundfish (some halibut)	L	Bottom longline/handline	1999-2003 2007-2009	DFO 2005a VDC 2009
Herring	H	Mid-water gillnet	1999-2003 2007-2009	DFO 2005a VDC 2009
Crab (other than snow crab)	L	Pot	1999-2003	DFO 2005a
Bluefin tuna	L	n/a	1999-2003	DFO 2005a
Mackerel	L	Trap net	1999-2003	DFO 2005a
Lobster	L	Trap	2008	VDC 2009
Soft-shell clams	H	N/A	2007-2009	CDD 2010

*H = high, M = medium, L = low

Aquaculture

There is one aquaculture license in the entire study area and it is located in Jeddore Harbour (see Figure 4.52, Service Nova Scotia 2008). It is 18.43 ha (0.18 km^2) in size and is a mussel aquaculture site (*Ibid.*). Aquaculture makes up only 0.15% of the study area. The site is assumed to be operational as it was sampled under the EMP (Service Nova Scotia 2008; NSDFA 2006).

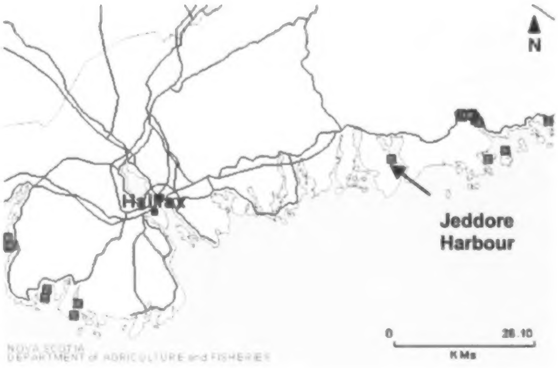


Figure 4.52 Aquaculture Licenses/Leases from Chezzetcook to Jeddore Harbour (denoted by green squares) (Service Nova Scotia 2008)

Tourism, Recreation, and Culture

The Chezzetcook to Jeddore area presents several recreational and ecotourism opportunities including swimming, hiking, salmon angling, and bird watching which occur in the several protected areas including Martinique Beach Provincial Park and the well-known Ramsar site of Musquodoboit Harbour (McCullough *et al.* 2005). Harbours in the area include East Jeddore, Petpeswick, Ostrea Lake, and East Chezzetcook. There is a Yacht Club in Petpeswick Inlet. There is more tourist infrastructure in the study area than areas further east. Infrastructure includes motels, inns, cottage rentals, bed and breakfasts, restaurants, two museums (including Fisherman's Life Museum at Jeddore Oyster Ponds), and Seacoast Escapes Adventure Tours (CCN 2006).

There is some concern that increasing recreational activities may be compromising the ecological integrity of the area (McCullough *et al.* 2005).

Current Protection and Research/Conservation Initiatives

There are numerous terrestrial and intertidal protected areas in the area, except in Jeddore Habour. These include:

- Lower East Chezzetcook Non-designated Park or Park Reserve
- Lower East Chezzetcook Protected Beach
- Lower East Chezzetcook EHJV Lands
- Martinique Beach Provincial Park
- Martinique Beach Game Sanctuary (includes marine component)
- Musquodoboit Harbour Outer Estuary Ramsar Site - 1925 ha, covers marine areas
- NCC lands on Francis Nose Island
- NSNT lands along the coast at Ostrea Lake (73.45 ha) (NSNT 2009)
- Musquodoboit Harbour has most protection
- Musquodoboit IBA

(NSDNR 2006b; Service Nova Scotia 2006)

There is significant interest from some provincial departments in increased protection of this area, particularly around Musquodoboit Harbour. There are several islands in the area of interest to DNR's Wildlife Division for the designation of adjuncts to the Eastern Shore Islands WMA to protect breeding bird colonies (NSDNR 2009a).

Lane and Associates (1992) identified Chezzetcook Harbour, among 16 other areas, as a potential site of significance during an initial scoping exercise, but later dropped the area prior to making its recommendations to Parks Canada. Parks Canada is not currently pursuing an NMCA designation in the Scotian Shelf marine region.

There are conservation and research efforts in the area, although most are for bird and bird habitat protection. Parts of this site are project areas under the EHJV of the North American Waterfowl Management Plan which will ensure that key habitat sites are protected. There has been a bird banding station in the area since the 1970s (McCullough *et al.* 2005).

Research was recently completed in the area involving LEK mapping of significant habitats and fishery-independent research which involved transect sampling of nine sites in Nova Scotia, one of which was the Chezzetcook to Jeddore Harbour area. The work was conducted by Bundy (2007) and is expected to be compiled and made publicly available in 2009.

DFO and NSDNR are collaborating on an initiative to identify appropriate methods to map and monitor eelgrass, using Port Joli and the Musquodoboit estuary as study areas. Eelgrass has recently been recognized as an Ecologically Significant Species (DFO 2009e) and is experiencing rapid declines globally which has several implications for ecosystem health (Waycott *et al.* 2009).

Summary

Table 4.30 below summarizes the key information provided in the site profile. Chezzetcook to Jeddore Harbour are ecologically significant with extensive eelgrass beds and salt marshes supporting several marine species and birds. The area meets three of the *Oceans Act* criteria for MPA establishment, however, the *Oceans Act* may not be the most appropriate tool to address the conservation needs of the area given the extensive intertidal zones in the inlets.

Table 4.30 Summary of the Chezzetcook to Jeddore Harbour Site Profile

***Oceans Act* Criteria (s.35)**	**Ecological Attributes**	**Human Uses**	**Current Protection and Research Initiatives**
(a) The conservation and protection of commercial and non-commercial fishery resources, including marine mammals, and their habitats; (b) The conservation and protection of endangered or threatened marine species, and their habitats (d) The conservation and protection of marine areas of high biodiversity or biological productivity	• Spawning area for pollock, herring, witch flounder, and potentially Atlantic cod and Atlantic salmon (outside the inlets) • Potential haddock nursery area • Extensive salt marshes and eelgrass beds • Abundance and diversity of invertebrates • SARA species: Piping Plover (breeding) • COSEWIC species: Atlantic cod • Birds: IBA (1), eelgrass habitat, geese, dabbling ducks, sea ducks	• Fishing - lobster - groundfish - herring - crab (other than snow crab) - soft-shell clam - sand and blood worm • Aquaculture: one shellfish site • Tourism and recreation • Proposed dredging • Moderate coastal development; primarily residential	• Several terrestrial protected areas • Conservation importance for provincial departments; opportunities for collaboration • Current research: - NSDNR-DFO eelgrass project - IEP (LEK mapping and fishery-independent surveys) - EHJV research (bird banding)

4.16 Taylor Head to Sheet Harbour

Taylor Head to Sheet Harbour is a sparsely populated area of the eastern shore that boasts recreational opportunities and provides habitat for shorebirds such as Common and Arctic Terns. Although little is known of the importance of the marine environment, there are potential spawning and juvenile areas for haddock and there is an abundance of marine algae. There are few users in the area, although there is a significant commercial port at Sheet Harbour.

Location and Population

Taylor Head and Sheet Harbour are located along the Eastern Shore of Nova Scotia in Halifax Regional Municipality approximately 100 km east of downtown Dartmouth. The study area is 56.2 km^2 and begins at Taylor Head (the headland at the tip of Taylor Head Provincial Park) and extends to the tip of Sober Island, extending approximately 5 km seaward from Mushaboom. There is only one town in the area, Sheet Harbour, with a population of approximately 828 (Destination Nova Scotia 2009). The eastern shore has some of the lowest populations in Nova Scotia. The average population density of the study area is 0-10 people per km^2 with 20-140 people per km^2 in a small area of Sheet Harbour (Municipal Services 2001). See the Taylor Head to Sheet Harbour location map (Figure 4.54).

Physical and Oceanographic Attributes

Sheet Harbour and Mushaboom Harbour are the two major waterbodies which make up the study area. Combined, they have a total area of 37.9 km^2 including intertidal areas and a total coastline length of 73 km (DFO 2007d). The area does not accurately represent the entire study area but makes up a significant portion. The coastline length is also an approximation. Sheet Harbour has a maximum depth of 20 m and has a relatively narrow intertidal zone (see Figure 4.53, DFO 2007d) compared with many coastal areas west of Taylor Head. The study area has a maximum depth of 30 m (CHS Charts 4013, 4227, 4235, 4236). There are numerous large and small islands in the area which are both privately and publicly owned (Service Nova Scotia 2006). The Taylor Head to Sheet Harbour area is classified as a Complex Pelagic Bay (Greenlaw 2009). The area has a high flushing time ranging from 54.1 to 55.3 hours. The watershed drainage area of Sheet Harbour is 944 km^2 and the tidal to freshwater ratio is low at 35.3:1. Mushaboom Harbour is tidally dominated with a tidal to freshwater ratio of 522.2:1 (DFO 2007d).

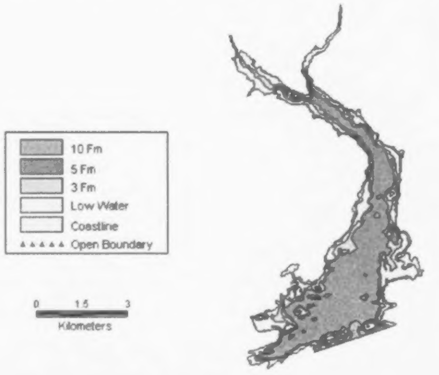
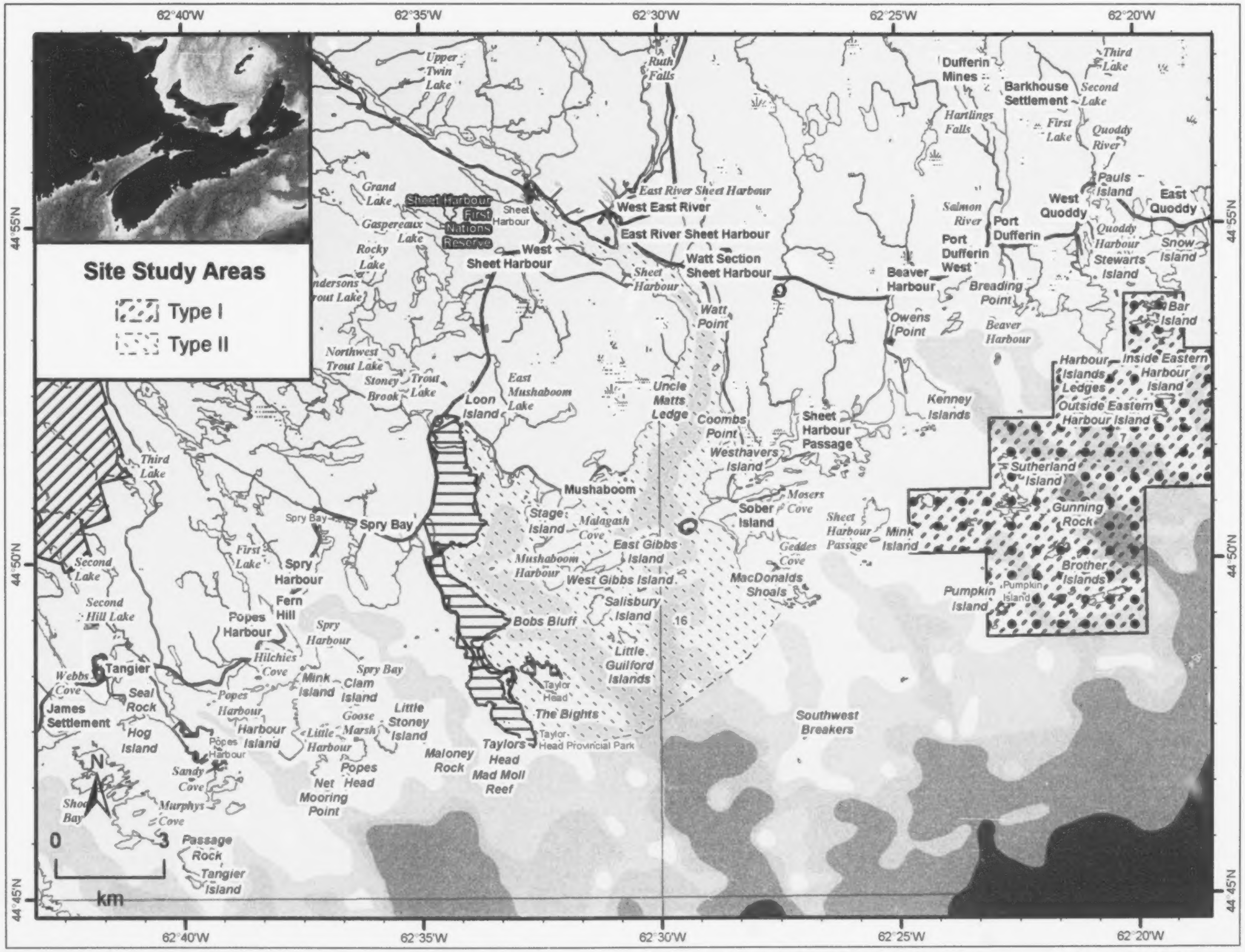


Figure 4.53 Sheet Harbour Bathymetry (DFO 2007d) 1 Fm = 1.83 m , Coastline = intertidal zone

Davis and Browne (1996b) describe the area as being characterised by its submerged rocky shoreline with elongated offshore islands primarily made up of greywacke bedrock. There are a variety of habitats, from rocky shores to extensive kelp and salt marsh areas, which are attributed to variable sediment accumulation. Some of these habitats and coastal features are illustrated in Figure 4.55. Many of the islands were formed by the erosion and submersion of headlands during recent coastal submergence. Unlike areas closer to Dartmouth, drumlin formations in this area are rare and salt marshes are small and scattered. The area does not have an abundance of sensitive coastal features like the Chezzetcook area, although there is an extensive marine flat in Taylors Head Provincial Park. Taylors Head has sand volcanoes and slump structures (Davis and Browne 1996b). The area is moderately sensitive to sea level rise (NRCan 2007).


62°40'W
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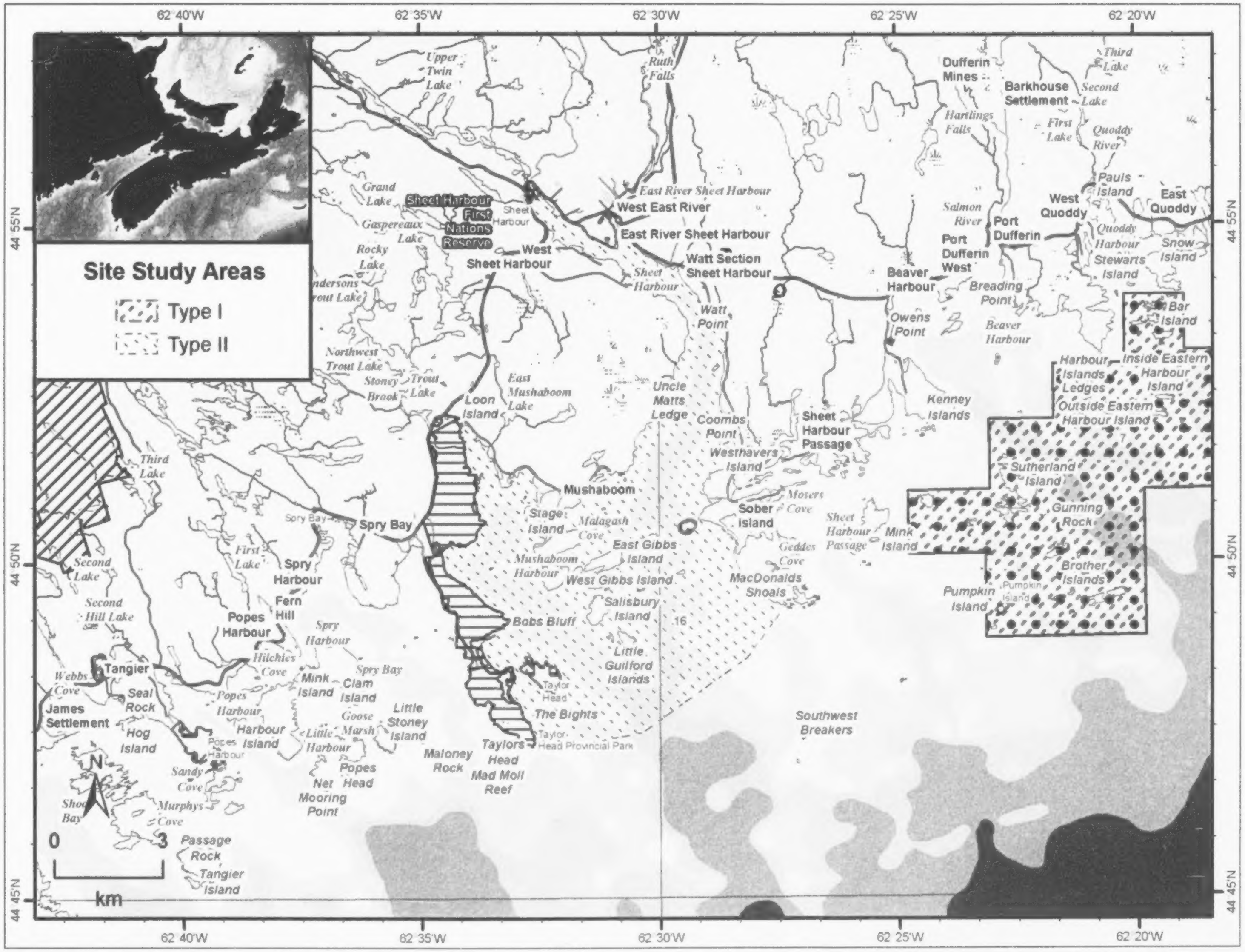
44°45'N
Site Study Areas
Type I
Type II
Upper Twin Lake
Ruth Falls
Dufferin Mines
Barkhouse Settlement
Third Lake
Second Lake
Hartlings Falls
First Lake
Quoddy River
Pauls Island
West Quoddy
East Quoddy
Grand Lake
Sheet Harbour First Nations Reserve
Sheet Harbour
Gaspereaux Lake
Rocky Lake
West Sheet Harbour
East River Sheet Harbour
West East River
Watt Section Sheet Harbour
Salmon River
Port Dufferin
Port Dufferin West
Quoddy Harbour
Stewarts Island
Snow Island
Beaver Harbour
Breading Point
Bar Island
Owens Point
Beaver Harbour
Watt Point
Northwest Trout Lake
Stoney Brook
Trout Lake
East Mushaboom Lake
Loon Island
Uncle Matts Ledge
Coombs Point
Sheet Harbour Passage
Kenney Islands
Harbour Islands Ledges
Inside Eastern Harbour Island
Outside Eastern Harbour Island
Westhavers Island
Sutherland Island
Third Lake
Mushaboom
Moshers Cove
Sober Island
Sheet Harbour Passage
Mink Island
Gunning Rock
Spry Bay
Stage Island
Malagash Cove
East Gibbs Island
Geddes Cove
First Lake
Spry Harbour
Mushaboom Harbour
West Gibbs Island
MacDonalds Shoals
Brother Islands
Pumpkin Island
Second Lake
Second Hill Lake
Fern Hill
Popes Harbour
Salisbury Island
16
Spry Harbour
Bobs Bluff
Little Guilford Islands
Hilchies Cove
Spry Bay
Webbs Cove
Tangier
Seal Rock
Mink Island
Clam Island
Taylor Head
Popes Harbour
James Settlement
Hog Island
Harbour Island
Little Harbour
Goose Marsh
Little Stoney Island
The Bights
Southwest Breakers
Popes Harbour
Taylors Head
Taylor Head Provincial Park
Maloney Rock
Mad Moll Reef
Sandy Cove
Popes Head
Net Mooring Point
Murphys Cove
Passage Rock
Tangier Island
N
0
3
km

Figure 4.54 Location Map for Taylor Head to Sheet Harbour (Site #16). Basemap layers: land 1: 50 000, 1: 250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); Restricted and Limited Use Land Database Layers (NSDNR 2006b). Refer to Figure 4.1 for legend.


Site Study Areas
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Sheet Harbour Passage
Mink Island
Gunning Rock
Spry Bay
Spry Bay
Stage Island
Malagash Cove
East Gibbs Island
Geddes Cove
Brother Islands
First Lake
Spry Harbour
Mushaboom Harbour
West Gibbs Island
MacDonalds Shoals
Pumpkin Island
Pumpkin Island
Second Lake
Second Hill Lake
Fern Hill
Salisbury Island
Popes Harbour
Spry Harbour
Bobs Bluff
16
Little Guilford Islands
Hilchies Cove
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Tangier
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James Settlement
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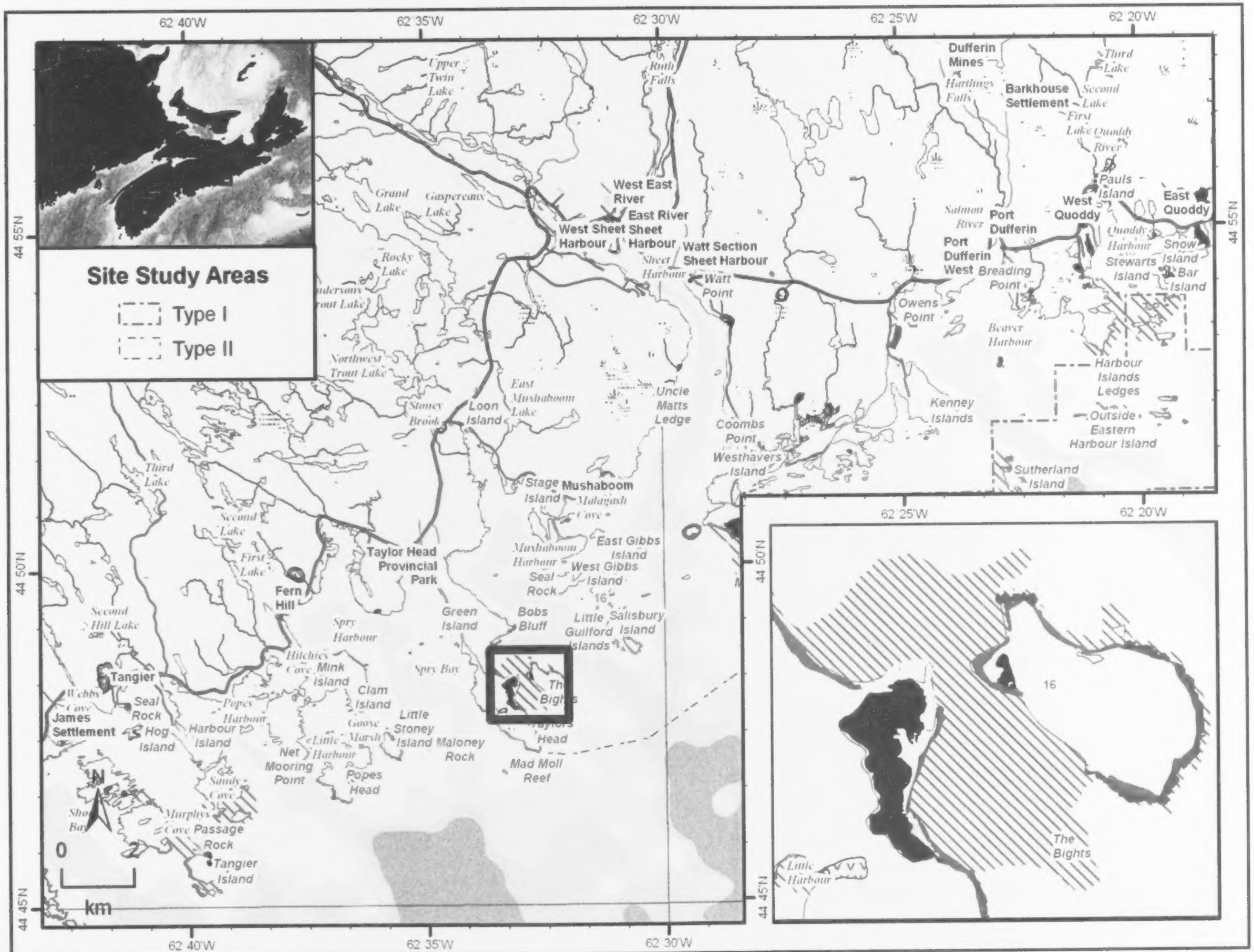
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Upper Twin Lake
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Pauls Island
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East Quoddy
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Gaspereaux Lake
West East River
East River Sheet Harbour
West Sheet Harbour
Sheet Harbour
Watt Section Sheet Harbour
Watt Point
Salmon River
Port Dufferin
Port Dufferin West
Breading Point
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Second Lake
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East Gibbs Island
Mushaboom Harbour
West Gibbs Island
Seal Rock
16
Taylor Head Provincial Park
Fern Hill
Second Hill Lake
Spry Harbour
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Little Guilford Islands
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James Settlement
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Popes Harbour
Harbour Island
Clam Island
Goose Marsh
Little Harbour
Little Stoney Island
Maloney Rock
Taylors Head
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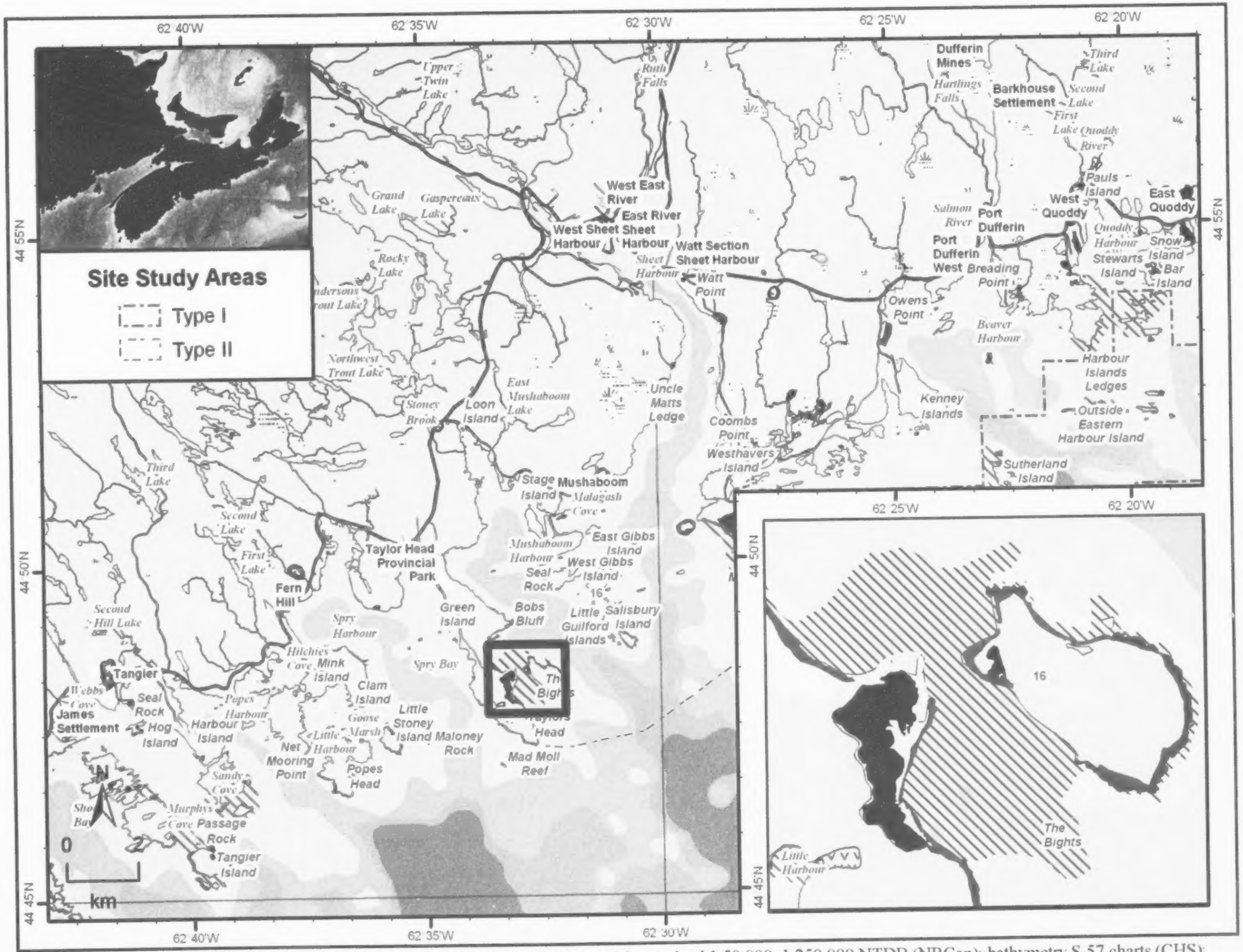
Popes Head
Mad Moll Reef
Sandy Cove
Murphys Cove
Passage Rock
Tangier Island
Shoal Bay
N
16
The Bights
Little Harbour

Figure 4.55 Coastal Habitats from Taylor Head to Sheet Harbour (Site #16).Basemap layers: land 1:50 000, 1:250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); NSDNR Wetlands Database layers (NSDNR 2000). Refer to Figure 4.2 for legend.


62 40'W
62 35'W
62 30'W
62 25'W
62 20'W
44 55'N
44 50'N
44 45'N
Site Study Areas
Type I
Type II
Upper Twin Lake
Ruth Falls
Dufferin Mines
Hartlings Falls
Barkhouse Settlement
Third Lake
Second Lake
First Lake
Quoddy River
Pauls Island
West Quoddy
East Quoddy
West East River
East River
West Sheet Harbour
Sheet Harbour
Watt Section
Sheet Harbour
Watt Point
Salmon River
Port Dufferin
Port Dufferin West
Breading Point
Quoddy Harbour
Stewarts Island
Snow Island
Bar Island
Grand Lake
Gaspereaux Lake
Rocky Lake
Andersons Trout Lake
Northwest Trout Lake
Owens Point
Beaver Harbour
Harbour Islands Ledges
Outside Eastern Harbour Island
Sutherland Island
Kenney Islands
Coombs Point
Westhavers Island
Uncle Matts Ledge
East Mushaboom Lake
Stoney Brook
Loon Island
Stage Island
Mushaboom
Malagash Cove
East Gibbs Island
Mushaboom Harbour
West Gibbs Island
Seal Rock
16
Third Lake
Second Lake
First Lake
Taylor Head Provincial Park
Fern Hill
Second Hill Lake
Green Island
Bobs Bluff
Little Guilford Islands
Salisbury Island
Spry Harbour
Spry Bay
The Bights
Taylors Head
Mad Moll Reef
Hitchies Cove
Mink Island
Clam Island
Goose Marsh
Little Stoney Island
Maloney Rock
Little Harbour
Net Mooring Point
Popes Head
Popes Harbour
Harbour Island
Tangier
Webbs Cove
James Settlement
Seal Rock
Hog Island
Sandy Cove
Murphys Cove
Passage Rock
Tangier Island
Shoal Bay
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The Bights
Little Harbour

Figure 4.55 Coastal Habitats from Taylor Head to Sheet Harbour (Site #16).Basemap layers: land 1:50 000, 1:250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); NSDNR Wetlands Database layers (NSDNR 2000). Refer to Figure 4.2 for legend.

Ecological Attributes

The Taylor Head to Sheet Harbour area was identified by scientific experts as an EBSA. It meets all of the EBSA criteria from a low to high degree (it has high resilience but it considered to have low naturalness). The area was identified twice by scientific experts in the EBSA identification process (Doherty and Horsman 2007).

The rocky shores of the Taylor Head to Sheet Harbour area provide an optimal environment for marine plant growth, although there has been little research on the importance of the area for algae. Transects taken in the 1980s demonstrate diverse and dense stands of algae (Moore and Miller 1986). There are few eelgrass beds and salt marshes in the area compared to other sites in this report (NSDNR 2000; Davis and Browne 1996b; HCESCRMP 1996). There are potential nursery areas for haddock (McCullough *et al.* 2005).

Haddock spawning occurs slightly offshore to the study area and the area is a potential recovery area for Atlantic salmon (Doherty and Horsman 2007) that currently spawn in the watershed in low numbers (DFO 2008e). Other anadromous fish include gaspereau and banded killifish (Davis and Browne 1996b). There is lobster bottom, rock crab and small scallop beds just outside of Sheet Harbour.

The naturalness of the area is considered low (Doherty and Horsman 2007) likely due to the impacts of industrial development including potential gold mine tailings at Sheet Harbour (NSE 2009c).

Bird Information

This stretch of coastline overlaps largely with the western half of the Eastern Shore IBA (Number NS027) which itself is known to host globally significant numbers of Common Eider during spring and fall migration, as well as continentally significant numbers of the species during the breeding season (BLI 2009). Harlequin Duck (special concern, SARA; Boyne 2008) also winter here in continentally significant numbers (BLI 2009). Although important numbers of Great Black-backed Gull, Herring Gull, Double-crested Cormorant, Common Eider, Common and Arctic Terns breed in this area, their numbers are not nationally significant. Eelgrass densities are assessed as intermediate here (MWI). Geese and dabbling duck numbers can reach high levels, while bay duck counts are high within the archipelago and sea duck numbers very high in more exposed zones (CWS).

Important Marine Ecological Features:

- Haddock spawning in offshore area
- Potential recovery area for Atlantic salmon
- Potential haddock nursery area
- Dense and diverse marine algae
- SARA-listed species: Harlequin Duck (special concern)
- Birds: IBA (1), species at risk, colonies, sea ducks

Humans Uses

Coastal industrial development, fisheries, aquaculture, and recreation are the human uses in the area. There is also a submarine cable that comes to shore at Beaver Harbour near Sheet Harbour (DFO 2005a).

Coastal Development

Although this area has a very low population and there is a comprehensive municipal planning strategy and associated land use bylaws (see Appendix D) (CBCL Limited 2009), strip residential development has impacted approximately 250 ha of the coast along Sheet Harbour (CBCL Limited 2009). High acidity from industrial development and dam construction have destroyed salmon habitat and caused the population to dwindle. Potential gold mine tailings from the Sheet Harbour Gold mine (NSE 2009c) may impact the ecosystem. There is potential for aggregate mining in Sheet Harbour (Lane and Associates 1992), however this is not authorized in Canada's marine waters.

Sheet Harbour is a significant commercial port with an offshore terminal and shipping facility, described as the "closest marine facility to the Sable Island Offshore Oil Fields" (McCullough *et al.* 2005). Several impacts are associated with shipping including but not limited to introduced species, pollution, erosion and sedimentation (if dredging is involved). The forests in the area have been heavily exploited and Sheet Harbour has become a centre for processing forest products and shipping pulpwood (Davis and Browne 1996b).

Commercial Fishing

Although there are several fisheries offshore from the Taylor Head and Sheet Harbour area, Lobster and crab are the only fisheries in the immediate area. Crabs were not recorded in the area from 2007-2009 (VDC 2009).

The lobster fishery in this area is of low importance at the provincial scale. In grid square 328, the reporting unit that most closely aligns with the study area, 2008 lobster landings are estimated at 73 MT. These landings comprise 0.24% of 2008 landings in DFO's Maritimes Region and 10.23% of LFA 32 landings in 2008. LFA 32 comprises 2.38% of 2008 landings in the Maritimes Region (VDC 2009).

There may be some active urchin licenses. In the 1999-2000 fishing season there were three active and three inactive fishing licenses in eastern Halifax County (DFO 2000). Current fishing activity is unknown. Table 4.31 below provides a summary of commercial fisheries in the Taylor Head to Sheet Harbour study area.

There are no wharves in the area and there is only one boat building facility (CCN 2006).

Table 4.31 Summary of Major Commercial Fisheries and Gear Used from Taylor Head to Sheet Harbour and the Adjacent Area

Species	**Landings***	**Gear**	**Year**	**Source**
Rock crab	L	Pot	1999-2003	DFO 2005a
Lobster	L	Trap	2008	VDC 2009

*H = high, M = medium, L = low

Aquaculture

There is one aquaculture license in the entire study area which is located in the lagoon area of Sober Island. It is an oyster license and is 4.76 ha (0.048 km^2) in size (see Figure 4.56, Service Nova Scotia 2008). Aquaculture makes up 0.08% of the study area. The site was not sampled through the EMP and may therefore not be in operation (Service Nova Scotia 2008; NSDFA 2006).

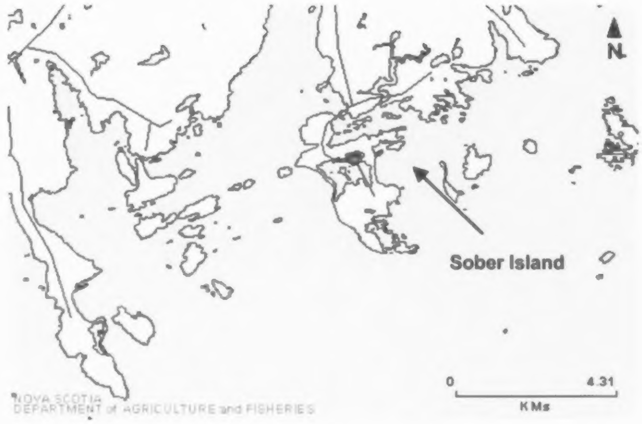


Figure 4.56 Aquaculture Licenses/Leases from Taylor Head to Sheet Harbour (denoted by green squares) (Service Nova Scotia 2008)

Tourism, Recreation, and Culture

Sheet Harbour has a variety of facilities and services, including a visitor information centre, a hospital, an RCMP detachment, a bank, restaurants, campgrounds and accommodations. "The settlement was begun in 1784 by Loyalist refugees and British veterans of the American Revolution and became a prosperous centre for the lumbering industry" (Destination Nova Scotia 2009). The Sheet Harbour First Nation reserve, located on the coast of Sheet Harbour, is a satellite reserve of the Millbrook First Nation which is located in Truro (Mi'kmaq Resource Centre 2010).

There are several recreational and ecotourism opportunities in the area including kayaking, hiking, bird watching, salmon angling, and swimming at the various parks including Taylors Head Provincial Park and the Liscomb Game Sanctuary (although this is not a coastal area).

Current Protection and Research/Conservation Initiatives

There is some adjacent terrestrial protection including Taylor Head Provincial Park, Pyches Island Non-designated Park or Park Reserve, and the Non-designated Park or Park Reserve at the head of Sheet Harbour (NSDNR 2006b; Service Nova Scotia 2006).

Minimal research on the marine environment has occurred in the area, and it is therefore difficult to determine the ecological significance of the area.

Summary

Table 4.32 below summarizes the key information provided in the site profile. There is very little information of the marine environment of this area. It meets two of the *Oceans Act* criteria for MPA establishment.

Table 4.32 Summary of the Taylor Head to Sheet Harbour Site Profile

***Oceans Act* Criteria (s.35)**	**Ecological Attributes**	**Human Uses**	**Current Protection and Research Initiatives**
(a) The conservation and protection of commercial and non-commercial fishery resources, including marine mammals, and their habitats; (d) The conservation and protection of marine areas of high biodiversity or biological productivity	• Haddock spawning area offshore • Potential recovery area for Atlantic salmon • Potential haddock nursery area • Dense and diverse marine algae • SARA species: Harlequin Duck • Birds: IBA, colonies, sea ducks	• Fishing - lobster - rock crab • Aquaculture: oyster (may not be operational) • Significant commercial port • Potential impacts of mine tailings from gold mine in Sheet Harbour • Some recreation	• Very few protected areas, although Taylor Head Provincial Park is a large part of the study area • Current marine data are lacking • IBA

4.17 St. Marys River

There is very little information on the importance of the marine environment in the St. Marys estuary, however, it is a known area of importance for Atlantic salmon. Sherbrooke is at the head of the estuary and is home to Nova Scotia's largest museum site. There are very few uses of the marine environment.

Location and Population

St. Marys River is located in Guysborough County in a rural area with a very low population and population density. The study area is 22.6 km^2 and contains much of the estuarine environment of St. Marys River, as far inland as Sherbrooke and extends approximately three km offshore and includes Wedge Island. See Figure 4.58 for a location map of St. Marys River. The eastern shore has some of the lowest populations in Nova Scotia. The population density of the study area is very low with an average of 0-10 people per km^2 (Municipal Services 2001). The closest and most populated town to the study area is Sherbrooke located along St. Marys River with a population of approximately 400 (St. Marys Riverside Lots 2008).

Physical and Oceanographic Attributes

St. Marys River has a total area of approximately 11 km^2 and a coastline of approximately 42.7 km from the mouth of the river to Sherbrooke (DFO 2007d). The estuary has a maximum depth of approximately 10 m at the mouth of the river and is predominately intertidal from the mouth inland (see Figure 4.57). The watershed drainage area is large at 1512.4 km^2 and the bay is flushed by tidal currents in 37.3 hours and has a tidal to freshwater ratio of 12.5:1 (DFO 2007d). The estuary is classified as a complex mixed estuary (Greenlaw 2009).

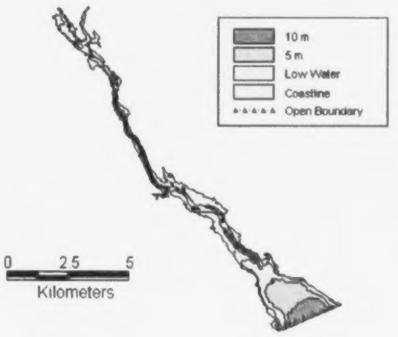
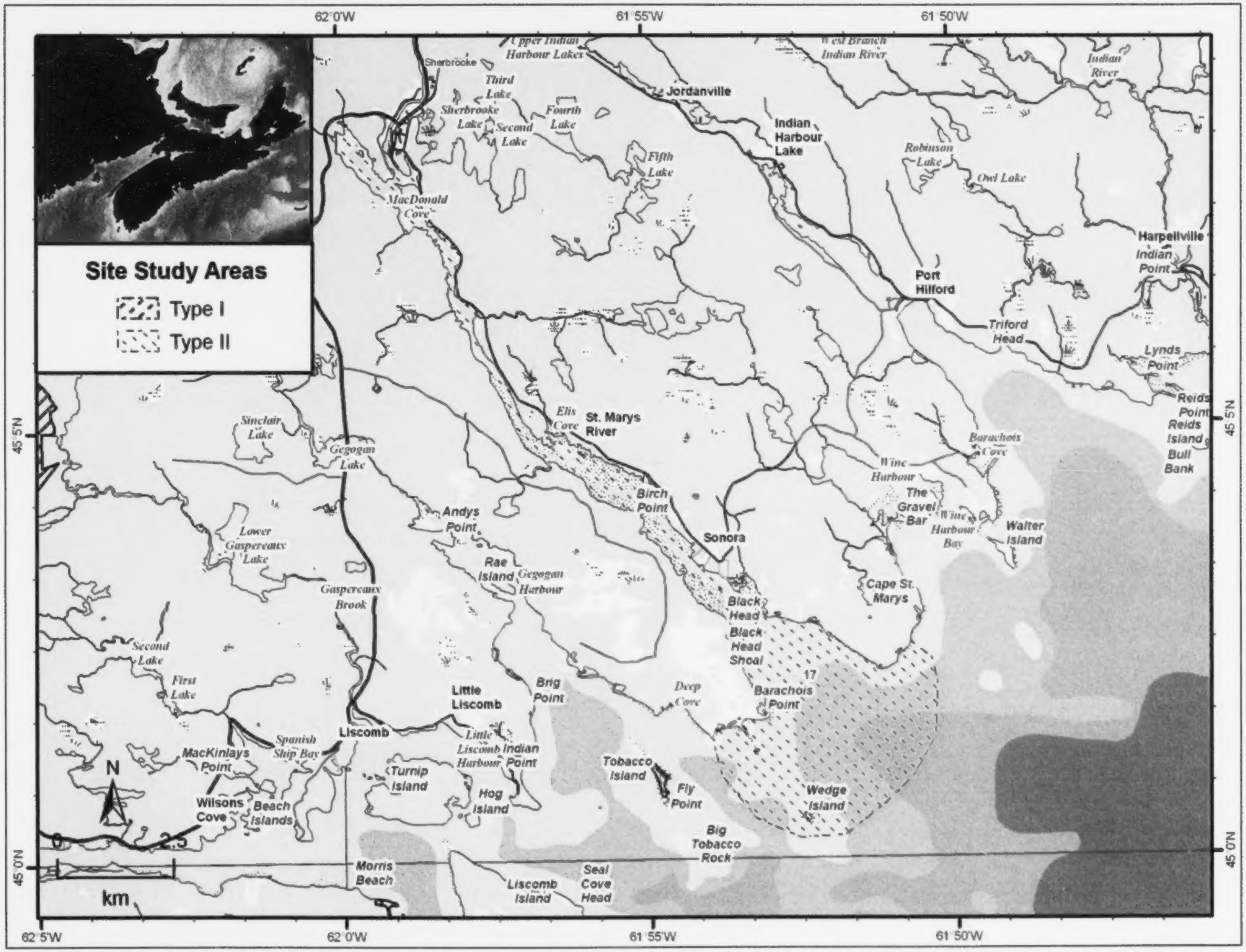


Figure 4.57 St. Mary's River Bathymetry (DFO 2007d) Coastline = intertidal zone

Davis and Browne (1996b) describe the physical and oceanographic features of the area. Bedrock in this region is predominately greywacke which faulted due to slip movements creating parallel faults which have produced relatively straight river valleys. These valleys were inundated by the sea creating long narrow inlets, such as St. Marys River. Coastal sediment supply is limited and there are few beaches in the area. There are several lakes and a few small fresh and saltwater wetlands. St. Marys estuary has some tidal marshes but they are less abundant than in other areas due to a lack of sediment supply. St. Marys River has a total of seven estuarine flats which have a combined area of 2293 ha (McCullough *et al.* 2005). Figure 4.59 illustrates rocky shores, but does not illustrate the other aforementioned features perhaps due to missing data in the NSDNR 2000 wetlands database. The terrestrial environment has both barren and semi-barren areas (Davis and Browne 1996b). The area is highly sensitive to sea level rise (NRCan 2007).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Site Study Areas
Type I
Type II
Sherbrooke
Upper Indian Harbour Lakes
Third Lake
Sherbrooke Lake
Second Lake
Fourth Lake
Fifth Lake
Jordanville
Indian Harbour Lake
West Branch Indian River
Indian River
Robinson Lake
Owl Lake
MacDonald Cove
Harpellville
Indian Point
Port Hilford
Triford Head
Lynds Point
Reids Point
Reids Island
Bull Bank
Elis Cove
St. Marys River
Sinclair Lake
Gegogan Lake
Barachois Cove
Wine Harbour
The Gravel Bar
Wine Harbour Bay
Walter Island
Birch Point
Sonora
Andys Point
Lower Gaspereaux Lake
Rae Island
Gegogan Harbour
Cape St. Marys
Gaspereaux Brook
Black Head
Black Head Shoal
17
Second Lake
First Lake
Little Liscomb
Brig Point
Deep Cove
Barachois Point
Spanish Ship Bay
Liscomb
Little Liscomb Harbour
Indian Point
MacKinlays Point
Turnip Island
Tobacco Island
Fly Point
Wedge Island
Hog Island
Wilsons Cove
Beach Islands
Big Tobacco Rock
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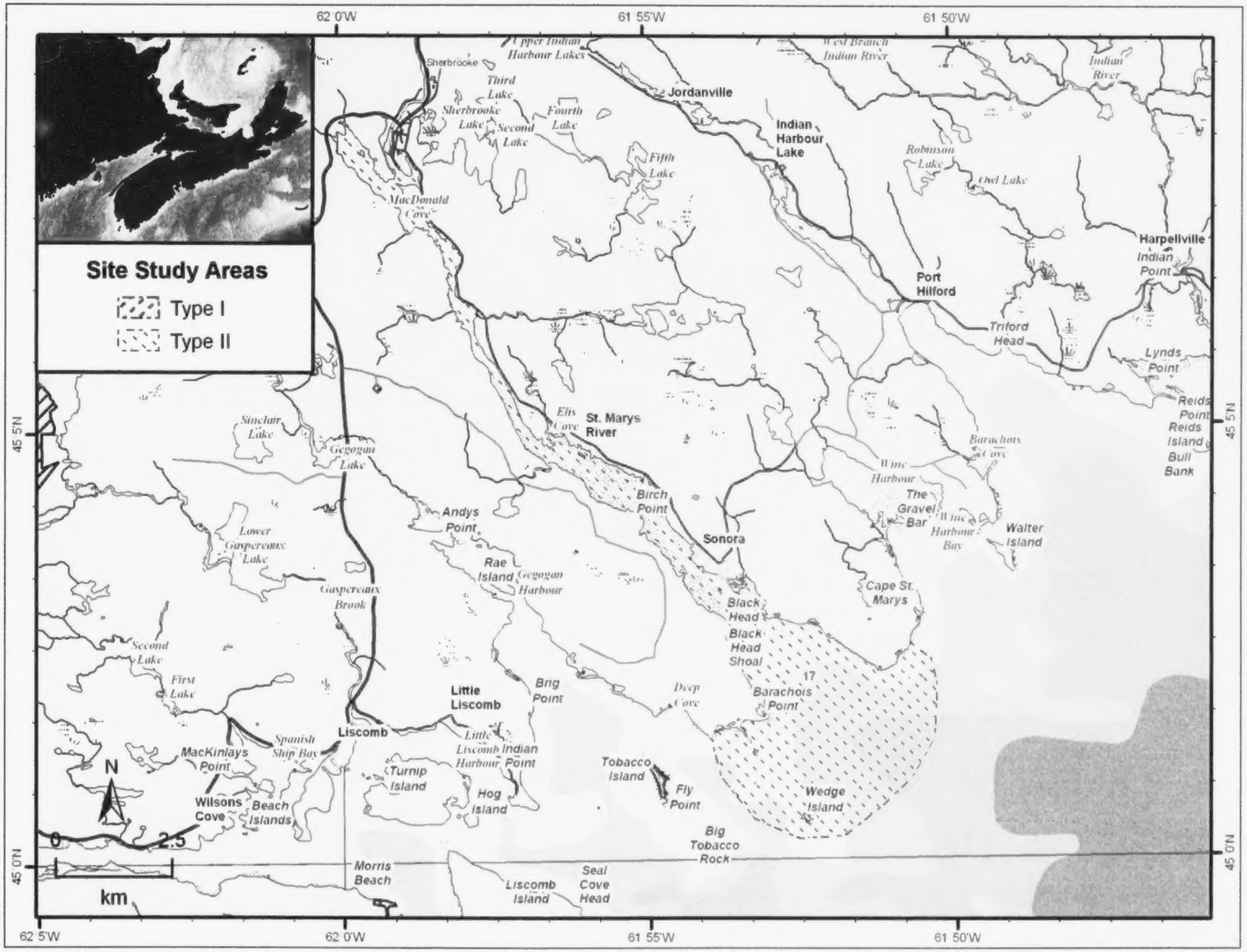
2.5
km
Morris Beach
Liscomb Island
Seal Cove Head

Figure 4.58 Location Map for St. Mary's River (Site #17). Basemap layers: land 1: 50 000, 1: 250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); Restricted and Limited Use Land Database Layers (NSDNR 2006b). Refer to Figure 4.1 for legend.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Site Study Areas
▨ Type I
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Sherbrooke
Upper Indian Harbour Lakes
Third Lake
Sherbrooke Lake
Second Lake
Fourth Lake
Fifth Lake
Jordanville
West Branch Indian River
Indian River
Indian Harbour Lake
Robinson Lake
Owl Lake
MacDonald Cove
Harpellville
Indian Point
Port Hilford
Triford Head
Lynds Point
Reids Point
Reids Island
Bull Bank
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St. Marys River
Sinclair Lake
Gegogan Lake
Barachois Cove
Wine Harbour
The Gravel Bar
Wine Harbour Bay
Walter Island
Birch Point
Sonora
Andys Point
Lower Gaspereaux Lake
Rae Island
Gegogan Harbour
Gaspereaux Brook
Cape St. Marys
Black Head
Black Head Shoal
17
Barachois Point
Second Lake
First Lake
Little Liscomb
Brig Point
Deep Cove
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Spanish Ship Bay
MacKinlays Point
Little Liscomb Harbour
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Hog Island
Tobacco Island
Fly Point
Wedge Island
Wilsons Cove
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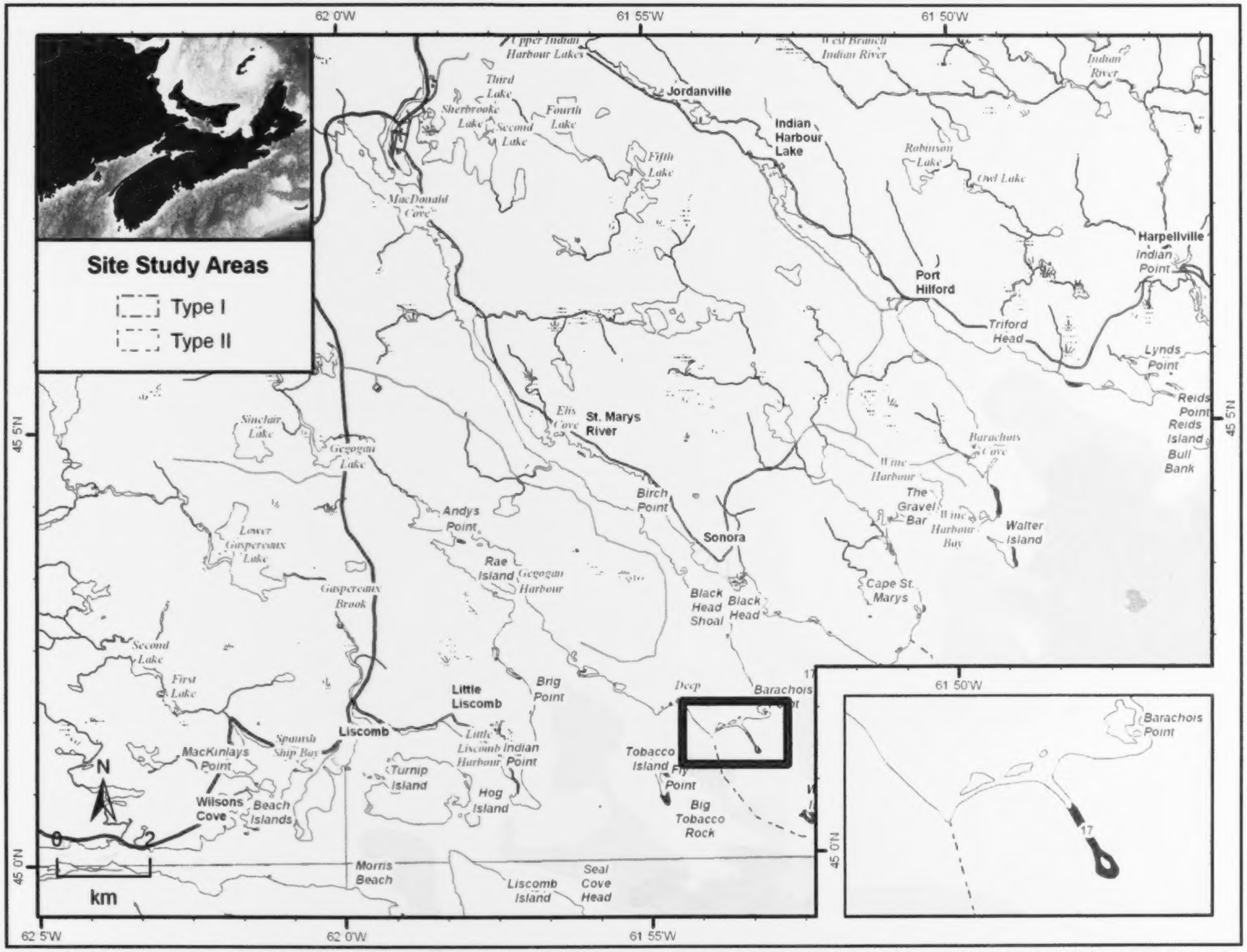
Big Tobacco Rock
Morris Beach
Liscomb Island
Seal Cove Head

Figure 4.58 Location Map for St. Mary's River (Site #17). Basemap layers: land 1: 50 000, 1: 250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); Restricted and Limited Use Land Database Layers (NSDNR 2006b). Refer to Figure 4.1 for legend.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Site Study Areas
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Upper Indian Harbour Lakes
West Branch Indian River
Indian River
Jordanville
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Sherbrooke Lake
Second Lake
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Indian Harbour Lake
Robinson Lake
Owl Lake
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Harpellville
Indian Point
Port Hilford
Triford Head
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St. Marys River
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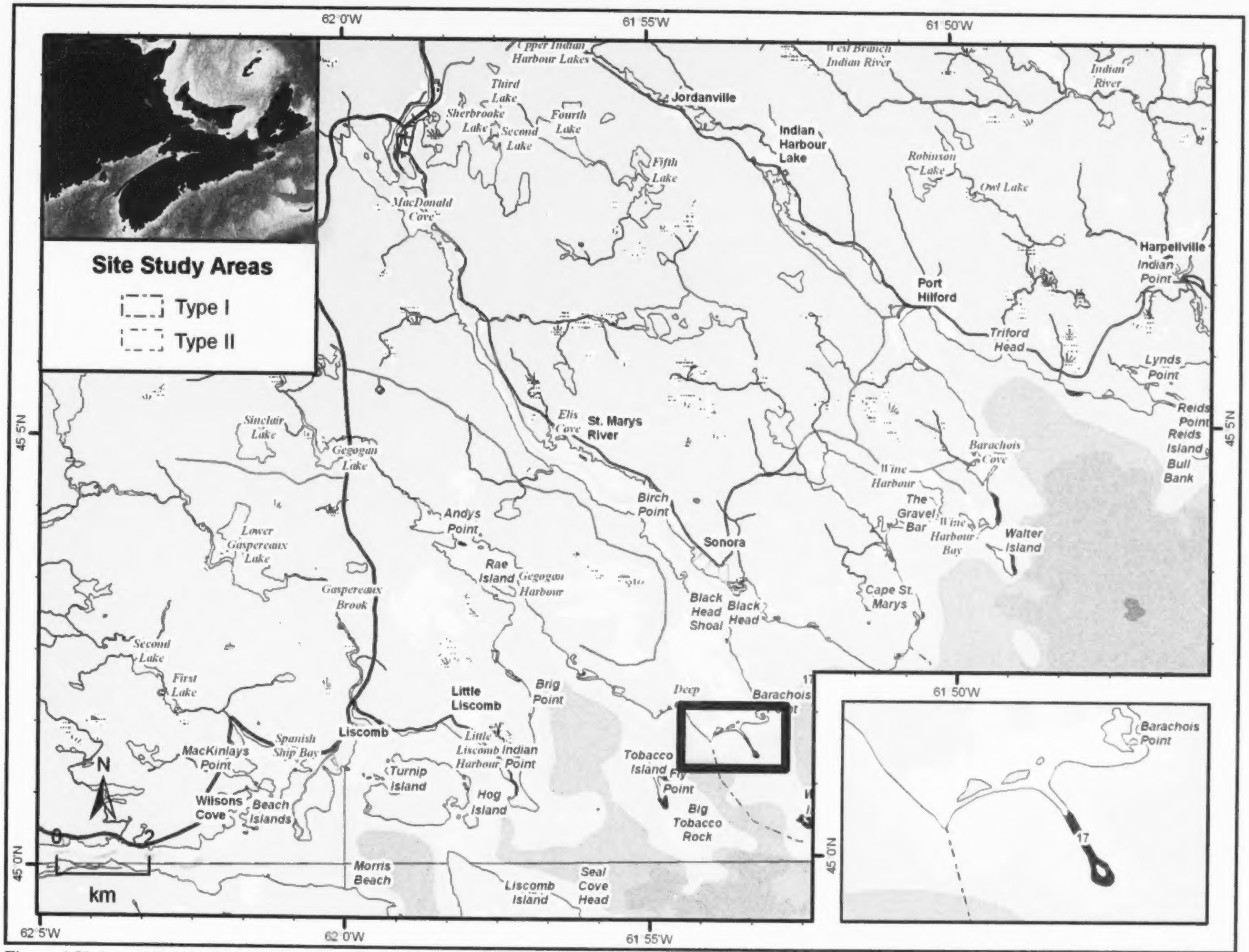
Morris Beach
Liscomb Island
Seal Cove Head

Figure 4.59 Coastal Habitats in St. Mary's River (Site #17). Basemap layers: land 1:50 000, 1:250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); NSDNR Wetlands Database layers (NSDNR 2000). Refer to Figure 4.2 for legend.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Site Study Areas
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Wilsons Cove
Beach Islands
Morris Beach
Liscomb Island
Seal Cove Head
Barachois Point

Figure 4.59 Coastal Habitats in St. Mary's River (Site #17). Basemap layers: land 1:50 000, 1:250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); NSDNR Wetlands Database layers (NSDNR 2000). Refer to Figure 4.2 for legend.

Ecological Attributes

The St. Marys River and watershed was identified by scientific experts as an EBSA. The area meets all EBSA criteria from a low to high degree (the area has high resilience and is highly unique). The estuary was identified once by scientific experts and the nearby Geogan Harbour was identified twice in the EBSA identification process (Doherty and Horsman 2007).

Very little is known about the ecological significance of the marine environment of St. Marys River. The watershed is a known salmon spawning area (Doherty and Horsman 2007) and there are other brackish water species such as the banded killifish and mummichog which inhabit the area (Davis and Browne 1996b). There are extensive eelgrass beds (NSDNR 2000) within the estuary and there are high densities of rockweed and kelp at the mouth of the estuary which contribute to primary productivity (Moore *et al.* 1986). Lobster bottom and recreational clam beds are found in the area (GCCRMP 1994).

The area is considered to have low naturalness (Doherty and Horsman 2007).

Bird Information

This area does not coincide or otherwise overlap with presently identified IBAs, and other than a small Herring Gull and a small Common Tern colony, no large or otherwise significant seabird/waterbird colonies are located here. Eelgrass densities are considered very high, and goose and dabbling duck numbers are assessed as very high and high, respectively. The area hosts high numbers of bay ducks, and very high numbers of sea ducks in the southwestern part of the outer estuary (CWS).

Important Marine Ecological Features:

- Important salmon spawning area
- Extensive rockweed and kelp
- Extensive eelgrass
- Birds: eelgrass habitat, geese, sea ducks

Human Uses

There are few human uses in St. Marys River which is quite undeveloped compared to other sites. These include fishing, aquaculture, and some tourism and recreation.

Coastal Development

The Municipality of the District of St. Marys has a comprehensive municipal planning strategy and associated land use bylaws (see Appendix D) (CBCL Limited 2009). There are several lots for sale for residential development along the St. Marys River (St. Marys Riverside Lots 2008). The exact location of the lots is uncertain and they may be further up the watershed, outside the study area. There is a sawmill in Sherbrooke which may affect the marine environment (Province of Nova Scotia 2007).

Commercial Fishing

Fishing activity in the study area is very low and is limited to crab other than snow crab and unknown landings of lobster (DFO 2005a; VDC 2009). Crab landings were recorded for 1999-2003 but were not recorded in recent years (VDC 2009).

Lobster landings in this area are low. Grid square 332, the reporting unit that most closely aligns with the study area, does not have any recorded lobster landings for 2008 (VDC 2009). This could be due to low reporting levels within the grid square. Due to low landings in adjacent grid squares, landings in this area are recorded as low.

There is one Small Craft Harbour in Sonora (CCN 2006), on the east bank of the river.

Table 4.33 below provides a summary of commercial fisheries around St. Marys River.

Table 4.33 Summary of Major Commercial Fisheries and Gear Used in and Adjacent to St. Marys River

Species	Landings*	Gear	Year	Source
Rock crab	L	Trap	1999-2003	DFO 2005a
Lobster	L	Trap	2008	VDC 2009

*H = high, M = medium, L = low

Aquaculture

There is no aquaculture in the study area but there are several licenses in adjacent inlets. The closest three licenses are in Wine Harbour (mussels) and Indian Harbour (rainbow trout) (see Figure 4.60, Service Nova Scotia 2008). Sampling for the EMP occurred in this area (NSDFA 2006) and the licenses are therefore assumed to be operational.

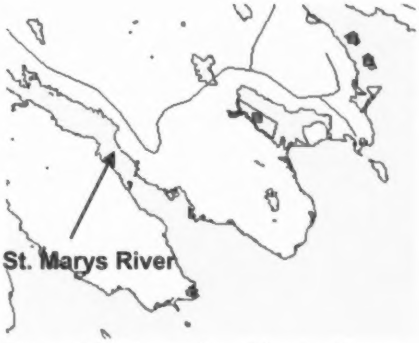


Figure 4.60 Aquaculture Licenses/Leases near St. Marys River (denoted by green squares) (Service Nova Scotia 2008)

Tourism, Recreation, and Culture

The area has ecotourism opportunities and tourist amenities including five bed and breakfasts, two lodges, and some cabin rentals. There are canoe and Kayak rentals in the area (CCN 2006). The area is very popular for fly fishing. Sherbrooke is home to Nova Scotia's largest museum site, Sherbrooke village, which was constructed to resemble the original village that stood in the 1860s. It has over 80 buildings and is considered a provincially significant heritage attraction. There are several festivals which take place at the museum in the summer months (Province of Nova Scotia 2009c).

Current Protection and Research/Conservation Initiatives

There is some provincial interest in conservation of the area. There are currently no protected areas in the St. Marys River area.

The St. Mary's River Association is currently working to conserve land and wildlife through land acquisition due to the threat of poorly managed development to this important watershed for salmon (St. Mary's River Association 2008).

Very little is known about the marine environment and there are no current research initiatives relevant to conservation planning.

Summary

Table 4.34 below summarizes the key information provided in the site profile. St. Marys River has very little information on the marine environment, although the area is an important salmon spawning area and there is indication of high primary productivity. The ecological attributes align with two of the *Oceans Act* criteria for MPA establishment.

Table 4.34 Summary of the St. Mary's River Site Profile

***Oceans Act* Criteria**	**Ecological Attributes**	**Human Uses**	**Current Protection and Research Initiatives**
(a) The conservation and protection of commercial and non-commercial fishery resources, including marine mammals, and their habitats; (d) The conservation and protection of marine areas of high biodiversity or biological productivity	• Important salmon spawning area • Extensive rockweed and kelp • Extensive eelgrass • Birds: eelgrass habitat, geese, sea ducks	• Fishing - lobster - rock crab • Minimal coastal development: sawmill and residential development • Aquaculture: finfish and shellfish • Some tourism and recreation	• Some provincial interest in conservation • One conservation initiative in the area for watershed protection • Marine data are lacking

4.18 Janvrin Island

Janvrin Island is an Acadian settlement with a long history of fishing. The decline of the fishery has resulted in economic diversification from a natural resource-based economy to a service-based economy, although fisheries continue at a smaller scale. Little is known about the marine environment except for the presence of extensive, pure stands of rockweed which surround the island.

Location and Population

Janvrin Island is located in Richmond County of Cape Breton Island, west of Isle Madame and in Chedabucto Bay at the mouth of the Strait of Canso. The study area is 11 km^2 and encompasses the main island and some of the surrounding islands, extending approximately 1 km seaward from any point on the island. See Figure 4.62 for a location map of Janvrin Island. The population density of the island is 20-140 people per km^2 (Municipal Services 2001). The population of Isle Madame and Janvrin Island combined is 3,455 (Province of Nova Scotia 2009b).

Physical and Oceanographic Attributes

Janvrin Island appears to be two islands, but the southern portion of the island is connected by a causeway on the east and there is a barrier beach on the west. Transport to Janvrin occurs via causeway from Isle Madame. Janvrin Island is in Chedabucto Bay and is surrounded by two other major water bodies, the Strait of Canso and Inhabitants Bay. The Strait of Canso and Inhabitants Bay have maximum depths of 64.0 m and 27.4 m, respectively (DFO 2007d). See Figure 4.61 for the bathymetry of Inhabitants Bay. The Strait of Canso has a watershed drainage area of 188.3 km^2, a tidal to freshwater volume ratio of 271.6, and a flushing time of 206 hours (*Ibid.*). Inhabitants Bay has a total area of approximately 33.4 km^2, a watershed drainage area of 476.9 km^2, a tidal to freshwater volume ratio of 112.1, and a flushing time of 62 hours (*Ibid.*).

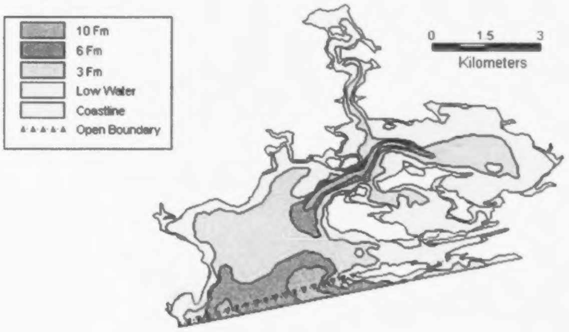
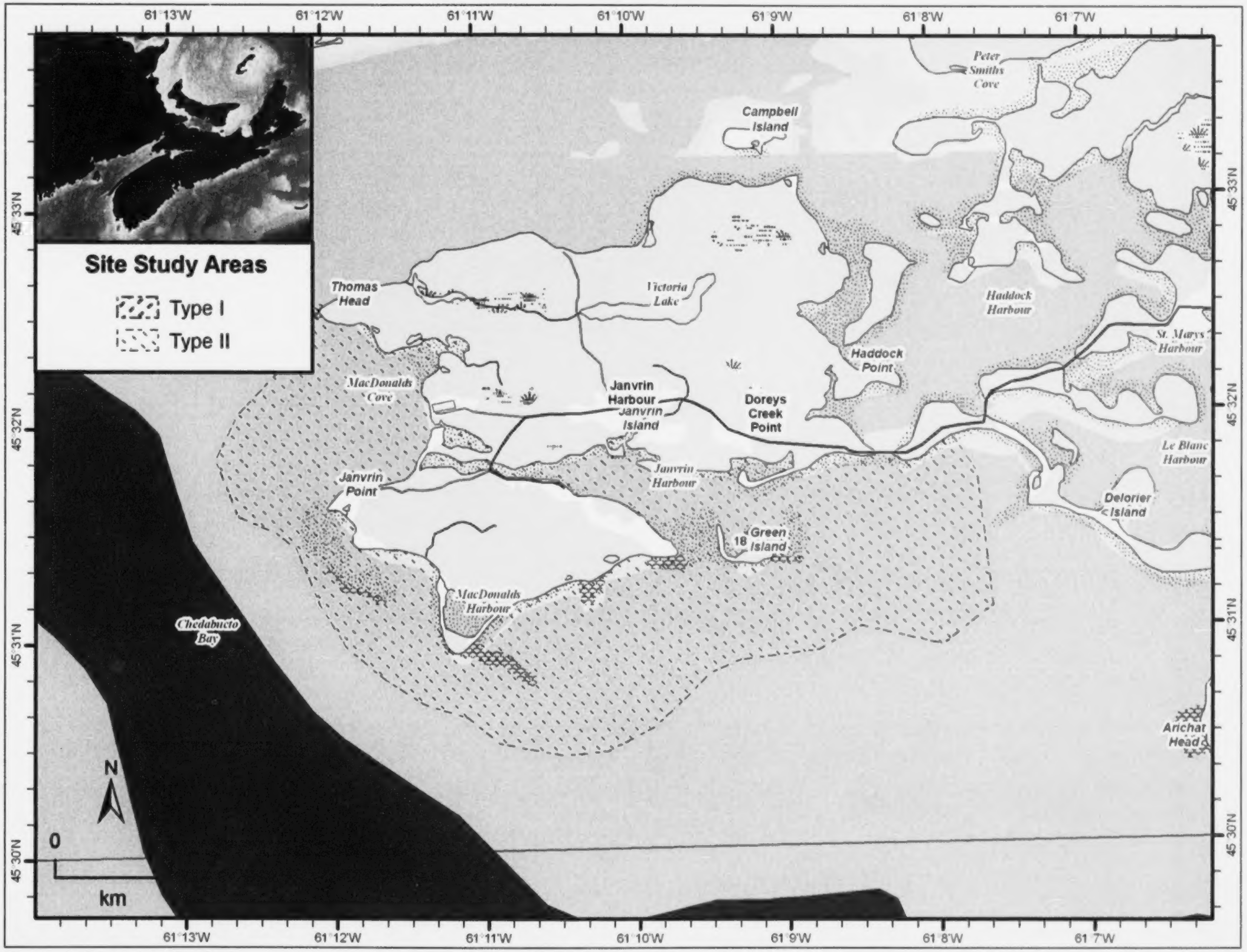


Figure 4.61 River Inhabitants Bathymetry (DFO 2007d)
1 Fm = 1.83 m , Coastline = intertidal zone

Janvrin Island and the surrounding areas are classified as sedimentary lowlands (Davis and Browne 1996b). The younger rock and soils of this area are more easily eroded than much of the coastline of Nova Scotia and includes deposits of salts, reddish siltstones, and fine sandstones which form rolling lowlands (*Ibid.*). Red and purple strata are exposed on Janvrin Island (*Ibid.*). The area is highly sensitive to sea level rise (NRCan 2007).

Drumlins are present in the Isle Madame and Janvrin Island area and marine erosion provides abundant sediment for cobble beaches which often have back-barrier lagoons and salt marshes (Davis and Browne 1996b). Figure 4.63 illustrates these coastal features. The terrestrial environment has barren and bog vegetation and the area provides habitat for wading birds. The area has warm summer temperatures, warmer than much of the Atlantic coast from 16-20ºC (Bundy *et al.* 2007), which allows for the survival of more southerly marine species during summer months. The presence of sea-ice prevents birds from overwintering and prevents the growth of extensive kelp in the marine environment (Davis and Browne 1996b). The maximum depth of the study area is 18.3 m (CHS Chart 4013).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Site Study Areas
Type I
Type II
Peter Smiths Cove
Campbell Island
Thomas Head
Victoria Lake
Haddock Harbour
St. Marys Harbour
Haddock Point
MacDonalds Cove
Janvrin Harbour
Janvrin Island
Doreys Creek Point
Le Blanc Harbour
Janvrin Point
Janvrin Harbour
Delorier Island
Green Island
18
MacDonalds Harbour
Chedabucto Bay
Arichat Head
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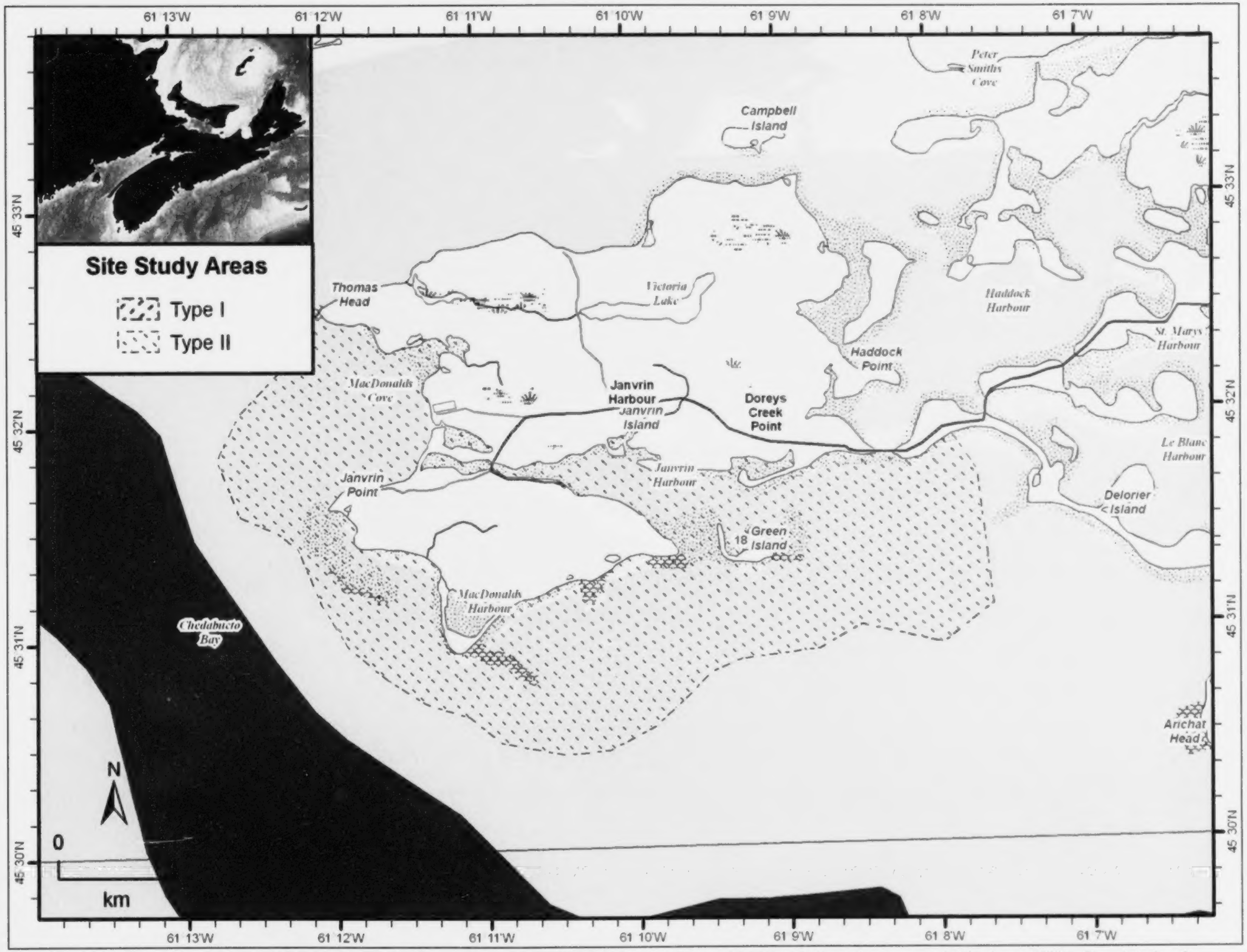
Figure 4.62 Location Map for Janvrin Island (Site #18). Basemap layers: land 1: 50 000, 1: 250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); Restricted and Limited Use Land Database Layers (NSDNR 2006b). Refer to Figure 4.1 for legend.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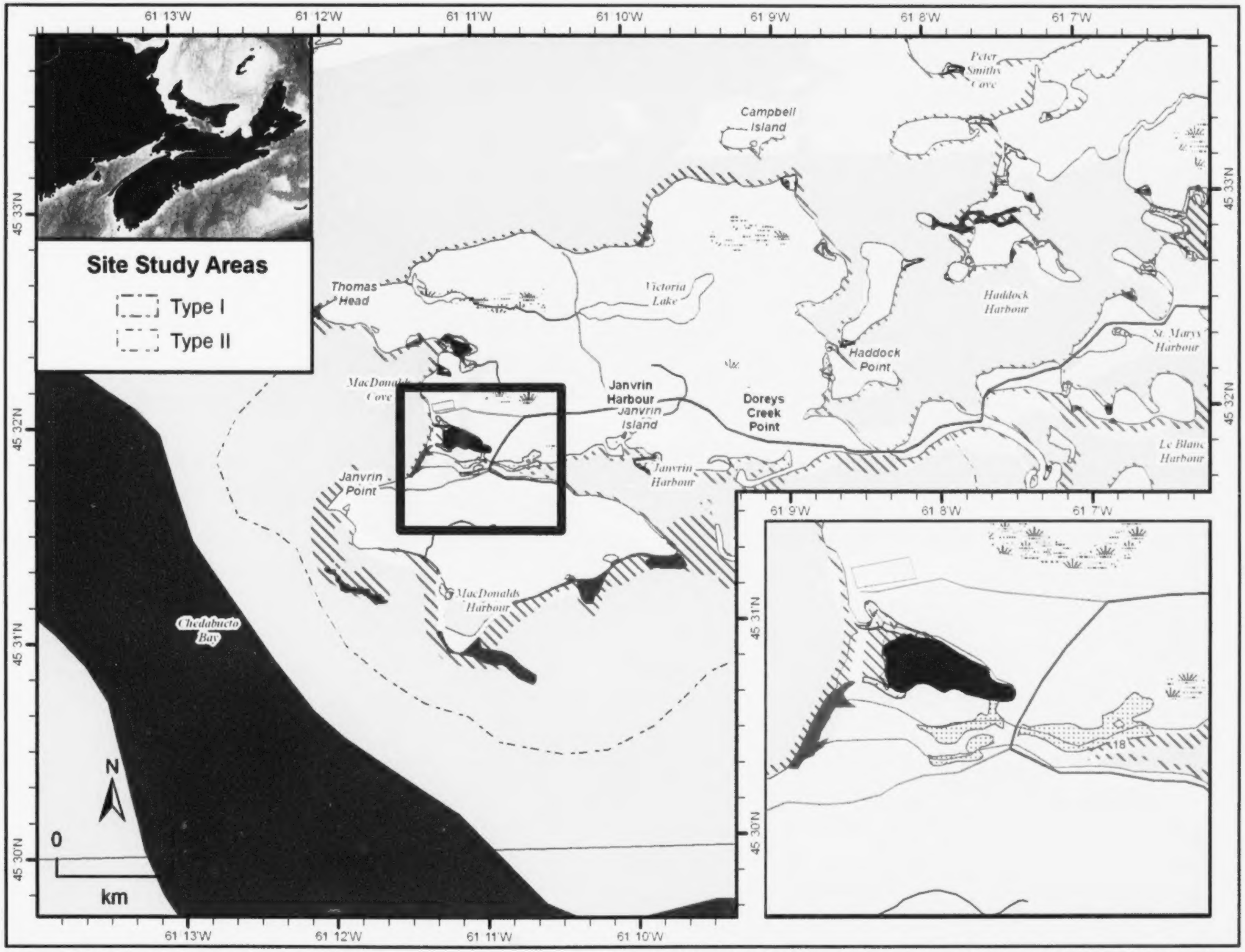
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MacDonalds Harbour
Chedabucto Bay
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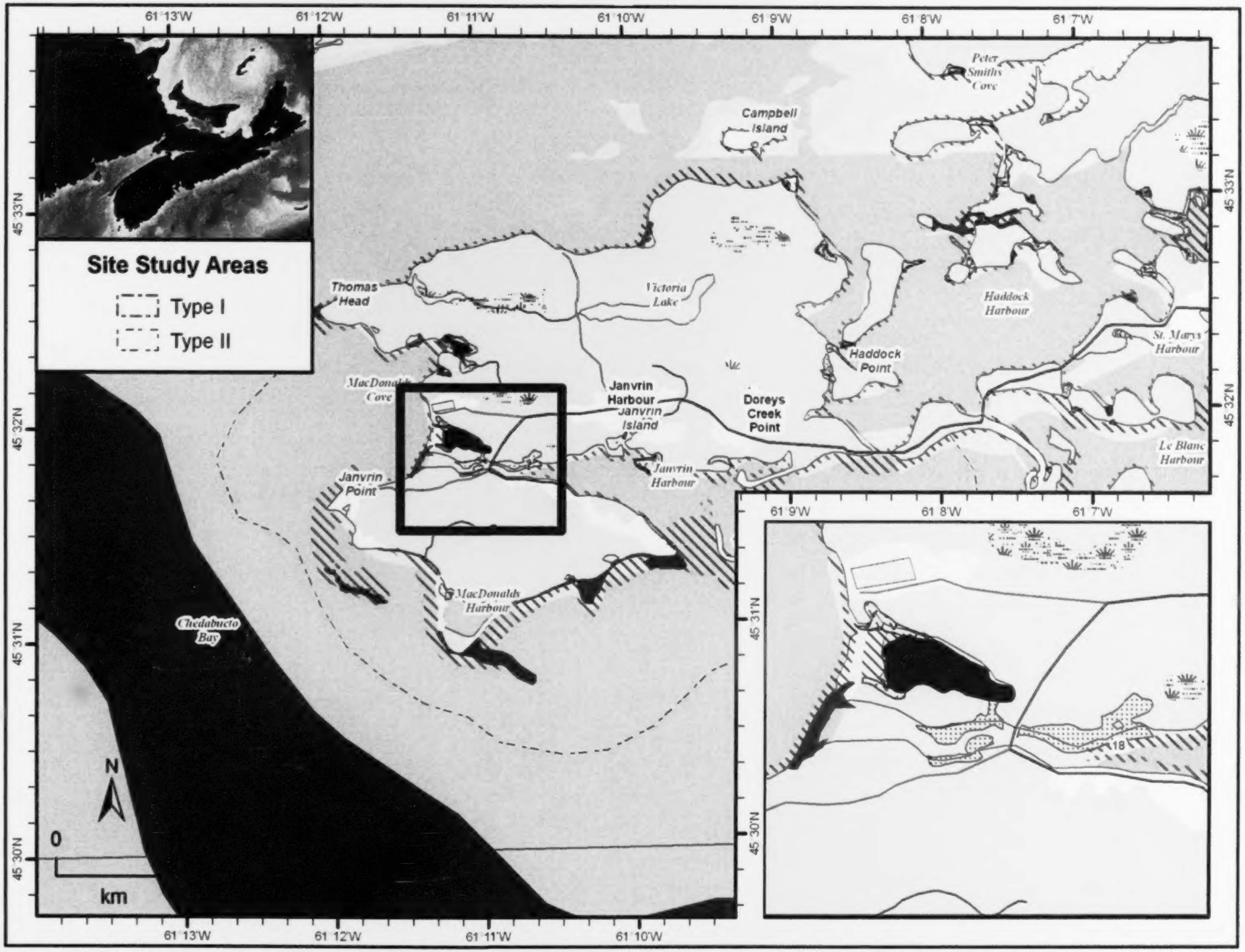
Figure 4.63 Coastal Habitats on Janvrin Island (Site #18). Basemap layers: land 1:50 000, 1:250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); NSDNR Wetlands Database layers (NSDNR 2000). Refer to Figure 4.2 for legend.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Janvrin Harbour
MacDonalds Harbour
Chedabucto Bay
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Figure 4.63 Coastal Habitats on Janvrin Island (Site #18). Basemap layers: land 1:50 000, 1:250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); NSDNR Wetlands Database layers (NSDNR 2000). Refer to Figure 4.2 for legend.

Ecological Attributes

Janvrin Island was identified by scientific experts as an EBSA. The area meets all EBSA criteria and was identified once by scientific experts in the EBSA identification process (Doherty and Horsman 2007).

Very little is known of the ecological significance of Janvrin Island. More information on the ecology of the area will become available upon publication of results from the Fishery-Independent Survey completed in 2006 as part of the DFO-FSRS IEP (DFO 2006a). Further, the analysis of LEK surveys of commercial fish harvesters which was also completed as part of the IEP in 2006, will contribute to the understanding of the ecological significance of the area.

Herring spawning occurred near the study area in the past, along the coast on the opposite side of the Strait of Canso (DFO 2001b), however, it was not identified as a herring spawning area in the 2009 Assessment of 4VWX herring (DFO 2009d). There may be aggregations of lobster, scallops, sea urchins, and clams, as noted in the Richmond County Coastal Resources Mapping Project (RCCRMP 1996), however, relative abundance is unknown.

The area is best known for its extensive monospecific rockweed beds, which were noted in the EBSA workshop in 2007 (Doherty and Horsman 2007). There is a high diversity of other marine algae species around Rabbit Island which also had a high density of urchins in a 1985 survey (Moore et al. 1986). There are also small patches of high and low salt marsh (NSDNR 2000).

The area met the EBSA criteria for naturalness in the 2006 EBSA workshop, although the degree was unspecified (Doherty and Horsman 2007). Naturalness is assumed to be low to moderate due to a high population density, aquaculture licenses, and presence of green crab. There are higher quantities of the invasive green crab compared to other sites in this analysis (31.5 crabs per trap haul) (Bundy *et al.* 2007).

Bird Information

This area does not coincide or otherwise overlap with presently identified IBAs. Although gulls and terns in colonies can number in the hundreds, levels do not reach national significance. Eelgrass densities in this area have been assessed as intermediate (Hanson and Calkins 1996). Although geese are not associated with the area, high numbers of dabbling ducks can occur here. Bay ducks are not typically detected in this area, while sea duck numbers can reach high levels (CWS).

Important Marine Ecological Features:

- Extensive monospecific rockweed beds
- Herring spawning in nearby waters in previous years

Human Uses

Janvrin Island shares many human uses with the Canso Ledges ecosystem, as they are both in Chedabucto Bay. In addition to high levels of coastal development, other uses in the Janvrin Island area include fishing, aquaculture, and shipping.

Coastal Development

Residential and commercial development is minimal in this area of the province, especially on Janvrin Island. The Municipality of the County of Richmond has a comprehensive municipal planning strategy and associated land use bylaws on Isle Madame, but not on Janvrin Island (see Appendix D) (CBCL Limited 2009).

The list of developments that are underway or completed in the large area surrounding Chedabucto Bay and the effects of some of these developments are listed in the Canso Ledges site profile. Additional developments and effects of development around Janvrin Island include a boat building facility in Arichat (Isle Madame) (Environment Canada 2008b) and iron deposits found near Isle Madame (Bundy *et al.* 2007). There are no active mining operations in the area (NSDNR 2006a)

The ecological integrity of the area was compromised in 1970 when the Liberian oil tanker ARROW ran aground causing an oil spill of 180,000 barrels of Bunker C. Fuel at Cerebrus Rock south of Isle Madame (Environment Canada 2006).

The area may have potential for wind energy development, with high wind speeds of 7.51-8.5 m/s on the island and the same speeds occur on adjacent Isle Madame (Province of Nova Scotia 2010).

Commercial Fishing

There are very few fisheries within the study area. Lobster and scallops are the only species currently fished directly within the study area according to 2007-2009 data from DFO's MARFIS database (VDC 2009). Mackerel fishing occurs on the opposite side of Chedabucto Bay, outside the study area (VDC 2009) but is in close proximity to the study area. According to 1999-2003 data, groundfish were caught at low levels in the area (DFO 2005a). Shrimp were landed in the study area from 2007-2009 with low to moderate landings (VDC 2009).

Although this is not the most important area for lobster in Nova Scotia, Chedabucto Bay has experienced a recent boom in the industry as landings have increased over the last few years (M.J. Tremblay, DFO Science Branch, pers. comm. 2009 and A. Silva, DFO Science Branch, pers. comm. 2009). Landings in the study area are moderate. In grid squares 341 and 342, the reporting units that most closely align with the study area, 2008 lobster landings are estimated at 347 MT. These landings comprise 1.17% of 2008 landings in the Maritimes Region and 32.14% of LFA 29 landings in 2008. LFA 29 comprises 3.63% of 2008 landings in the Maritimes Region (VDC 2009).

Janvrin Island has one wharf, which is for recreational use (CCN 2006). Table 4.35 below provides a summary of commercial fisheries around Janvrin Island.

Table 4.35 Summary of Major Commercial Fisheries and Gear Used in and Adjacent to the Janvrin Island Area

Species	Landings*	Gear	Year	Source
Scallop	L	Dredge	1999-2003 2007-2009	DFO 2005a VDC 2009
Lobster	M	Trap	2008	VDC 2009
Groundfish	L-M	Longline	1999-2003	DFO 2005a
Mackerel	L	Trap net	1999-2003 2007-2009	DFO 2005a VDC 2009
Shrimp	L	Trap	2007-2009	VDC 2009

*H = high, M = medium, L = low

Aquaculture

Although there are no aquaculture licenses in the immediate study area, there are three proposed licenses north of Janvrin Island for blue mussels (see Figure 4.64, Service Nova Scotia 2008). There are several other licenses near the island, the closest of which are around Isle Madame, three are proposed and two are active. All licenses are for blue mussels and sea scallops (Service Nova Scotia 2008). Samples were taken in 2004 for the EMP and these sites are therefore assumed operational (NSDFA 2006).

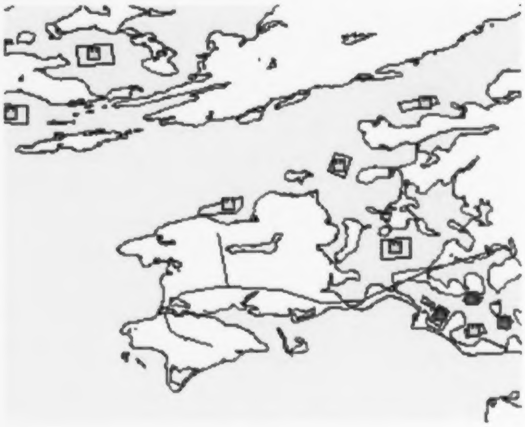


Figure 4.64 Aquaculture Licenses/Leases around Janvrin Island (proposed = blue squares, issued = green squares) (Service Nova Scotia 2008)

Shipping

Although commercial shipping does not occur in the immediate study area, Chedabucto Bay is one of two areas with designated vessel traffic service zones along the Atlantic Coast of Nova Scotia, the other is Halifax Harbour (DFO 2005a). Shipping traffic comes and goes from Port Hawkesbury (NSE 2008). Large vessel shipping within Chedabucto Bay is expected to increase significantly when the Melford Terminal is operational (NSE 2008).The terminal at Point Tupper handles several large commercial vessels including large crude carriers of up to 400,000 deadweight (Gulf of Canso Museum of Archives 2009).

Tourism, Recreation, and Culture

Isle Madame was settled by a French merchant in the 1780s, John Janvrin, who went into the fish and retail trade of Cape Breton, opening fish processing plants and owned and operated ship building yards on Isle Madame. John Janvrin set up a fishing post in Janvrin Harbour (Janvrin's Island 2009). Seventy percent of the current population is bilingual and there are strong ties to Acadian culture (Development Isle Madame Association Ltd. 2006). Fisheries were once the mainstay of the Isle Madame-Janvrin Island community. The downturn of the fisheries has resulted in a shift from a resource-based industry to a service-based industry. Approximately 5% of the Isle Madame-Janvrin Island workforce is in fisheries with service and manufacturing making up over 50% (*Ibid.*).

There are several tourist and other amenities on Isle Madame including a grocery store, museums, and historic sites (Development Isle Madame Association Ltd. 2006).

Current Protection and Research/Conservation Initiatives

There are no coastal protected areas on or near Janvrin Island (Service Nova Scotia 2006).

There is a lack of information on the marine environment. Research was recently completed in the area as part of the IEP, including LEK mapping of significant habitats and fishery-independent transect sampling of nine sites in Nova Scotia, one of which is the Isle Madame-Janvrin Island area (DFO 2006a). The work is expected to be published in 2009 and will address some of the data gaps (A. Bundy, DFO Science Branch, pers. comm. 2009).

There are no known conservation initiatives occurring in the area.

Summary

Table 4.36 below summarizes the key information provided in the site profile. Janvrin Island has very little information on the marine environment, although current research initiatives will aid in determining the ecological significance of the island. The area only meets one of the *Oceans Act* criteria for MPA establishment.

Table 4.36 Summary of the Janvrin Island Site Profile

***Oceans Act* Criteria**	**Ecological Attributes**	**Human Uses**	**Current Protection and Research Initiatives**
(d) The conservation and protection of marine areas of high biodiversity or biological productivity	• Extensive monospecific rockweed beds • Herring spawning in nearby waters in previous years	• Fishing - lobster - groundfish - mackerel - scallop - shrimp • Aquaculture: shellfish • Minimal tourism and recreation • Minimal coastal development on Janvrin Island, but high levels of industrial (and potential industrial developments) in inner Chedabucto Bay • Shipping	• No terrestrial protection • Current research: IEP (LEK mapping and fishery-independent surveys)

4.19 Big Glace Bay

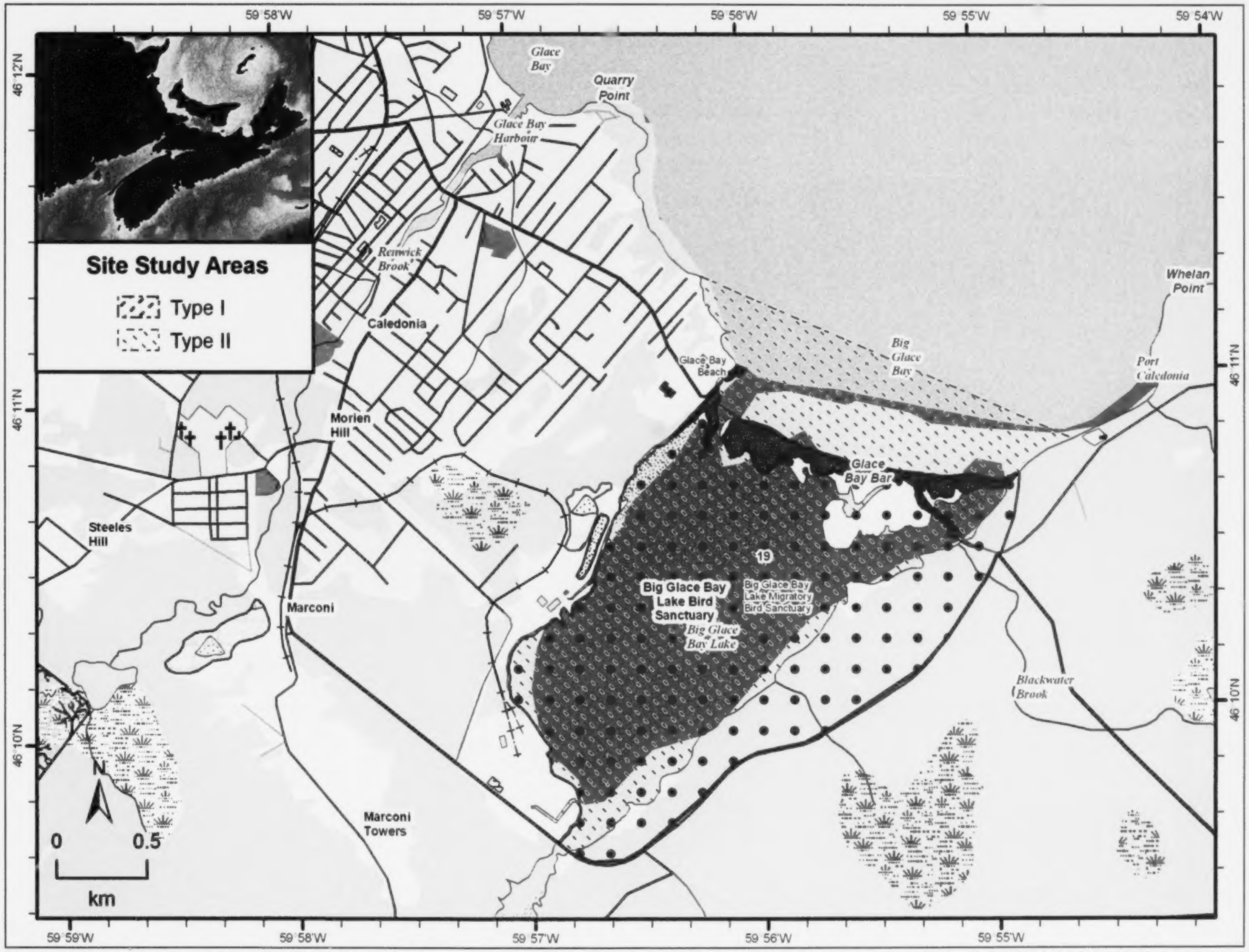
Big Glace Bay is located in an urban area of Cape Breton, on the outskirts of Sydney. Although there is little information about this area, it is important for migratory birds and is a spawning area for herring, Atlantic cod, and capelin. The marine and coastal environment of Big Glace Bay may be affected by the development of the Donkin submarine coal mine, if it proceeds.

Location and Population

Big Glace Bay is located on the northeast coast of Cape Breton Island in Cape Breton County (Cape Breton Regional Municipality) approximately 20 km from Sydney. The study area is 3.6 km^2 and encompasses Big Glace Bay Lake and extends less than 1 km offshore. See Figure 4.65 for a location map of Big Glace Bay. Due to the intertidal nature of the proposed EBSA boundary (Doherty and Horsman 2007), a larger area will be considered in this analysis to include entire Glace Bay, where most marine information is available. The surrounding area has the highest population in Cape Breton, due to its close proximity to Sydney with population densities ranging from 10 to over 140 people per km^2 (Municipal Services 2001). Glace Bay is the nearest town to the study area and has a population of 16,140 including surrounding communities (Province of Nova Scotia 2009b).

Physical and Oceanographic Attributes

Big Glace Bay is a relatively exposed embayment in Cape Breton and contains a barrier beach which shelters a coastal lagoon, "Big Glace Bay Lake". The barrier beach has a small opening at the northeast end, allowing for tidal exchange, and is composed of gravel, sand, and sparse vegetation (BSC 2009). The tidal range in the lagoon is 2-3 m (*Ibid.*). Big Glace Bay Lake has a large intertidal area which makes up half of the lake. There are eelgrass beds on the sand and mud flats of the lagoon. The terrestrial environment is low-lying around the lagoon and is fringed by low cliffs (*Ibid.*). Figure 4.66 illustrates the coastal features in the area. The area is moderately sensitive to sea level rise (NRCan 2007).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Site Study Areas
Type I
Type II
Glace Bay
Quarry Point
Glace Bay Harbour
Renwick Brook
Caledonia
Morien Hill
Steeles Hill
Marconi
Marconi Towers
Glace Bay Beach
Big Glace Bay
Whelan Point
Port Caledonia
Glace Bay Bar
19
Big Glace Bay Lake Bird Sanctuary
Big Glace Bay Lake Migratory Bird Sanctuary
Big Glace Bay Lake
Blackwater Brook
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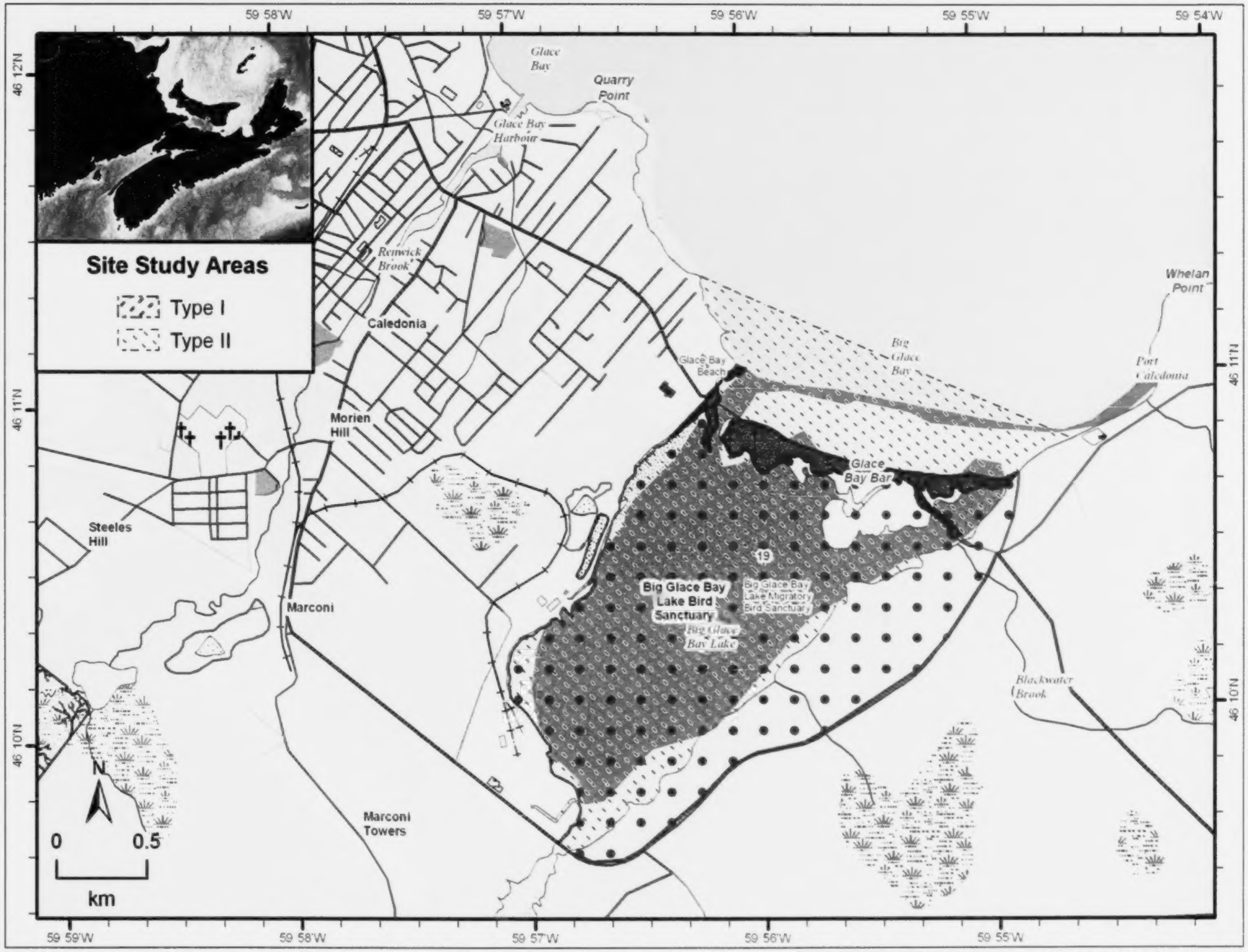
Figure 4.65 Location Map for Big Glace Bay (Site #19). Basemap layers: land 1: 50 000, 1: 250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); Restricted and Limited Use Land Database Layers (NSDNR 2006b). Refer to Figure 4.1 for legend.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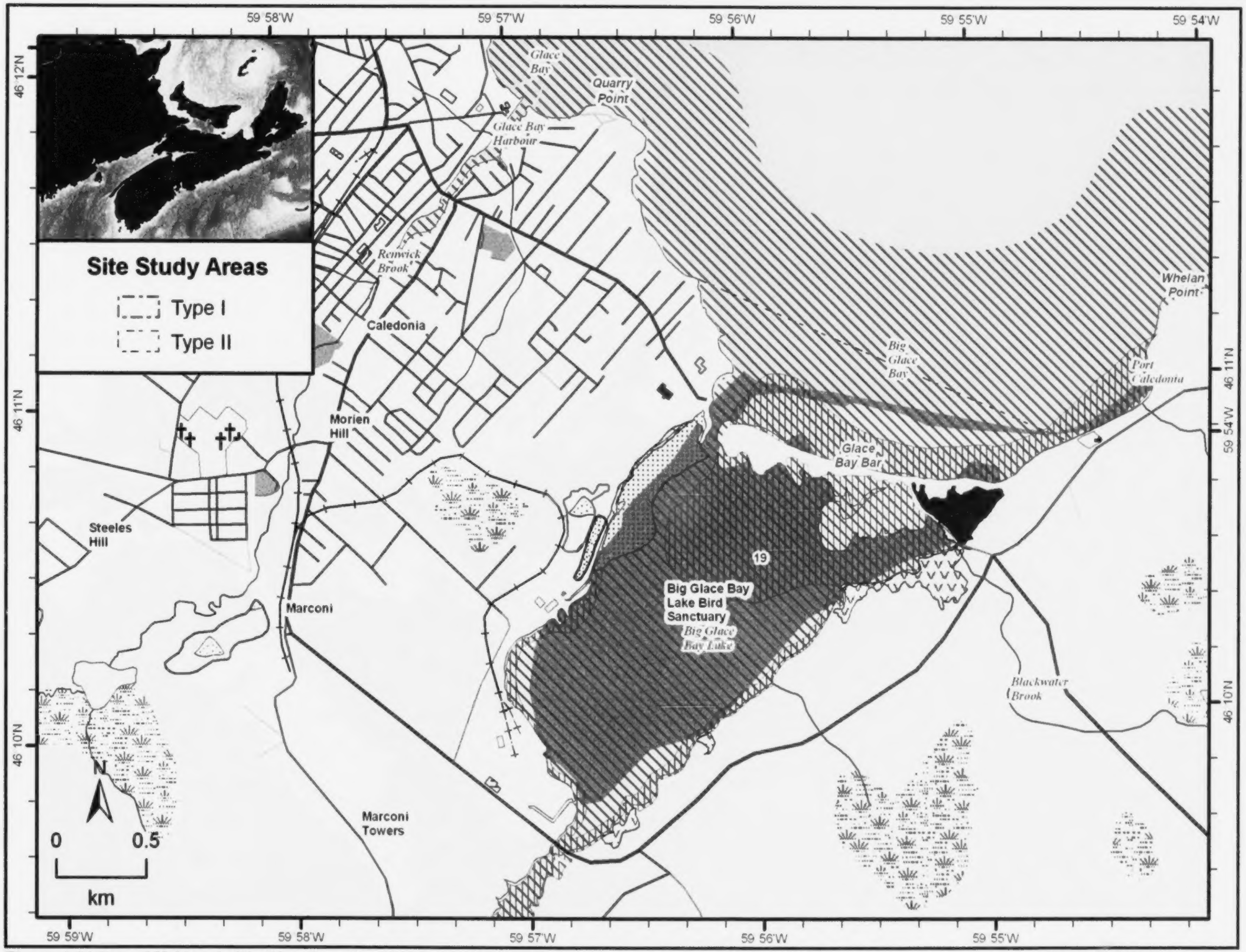
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Figure 4.66 Coastal Habitats in Big Glace Bay (Site #19). Basemap layers: land 1:50 000, 1:250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); NSDNR Wetlands Database layers (NSDNR 2000). Refer to Figure 4.2 for legend.

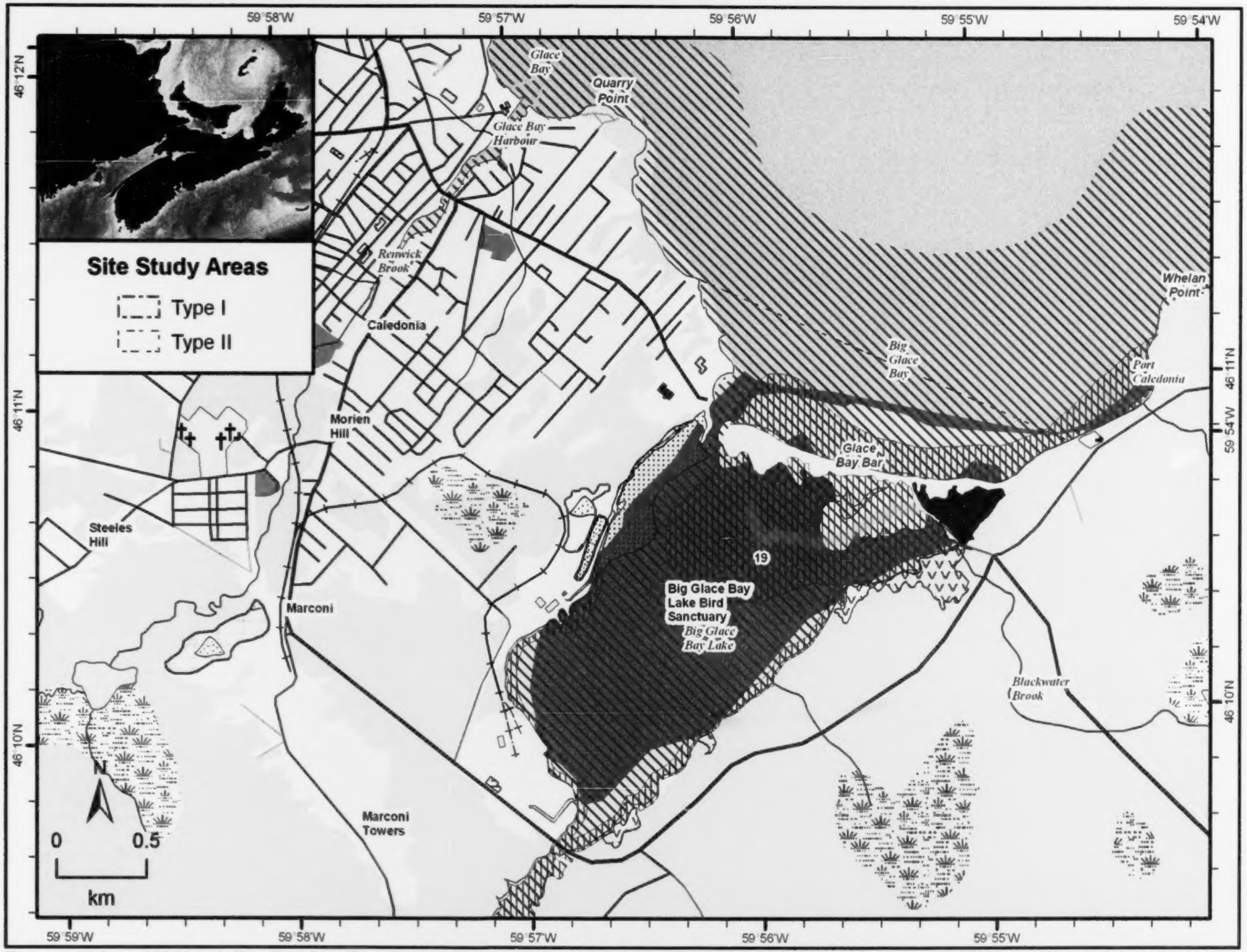
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Figure 4.66 Coastal Habitats in Big Glace Bay (Site #19). Basemap layers: land 1:50 000, 1:250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); NSDNR Wetlands Database layers (NSDNR 2000). Refer to Figure 4.2 for legend.

Ecological Attributes

Big Glace Bay was identified by scientific experts as an EBSA. The area meets all EBSA criteria from a low to high degree (the area has high aggregations, fitness consequences, and resilience). It was identified once by scientific experts in the EBSA identification process (Doherty and Horsman 2007).

More is known about Big Glace Bay Lake than the subtidal areas outside the lake, likely due to the lake's importance for birds. Big Glace Bay Lake is a MBS and an IBA. Bird information is further described below.

There is indication of marine significance in this area. The bay and surrounding area is known as a herring, Atlantic cod, and capelin spawning area (Bundy *et al.* 2007; Schaefer *et al.* 2004) and traditional ecological knowledge (TEK) indicates that Atlantic salmon is present in the lake and that the waters off Glace Bay are a herring overwintering area (Schaefer *et al.* 2004). However, recent herring surveys showed very little spawning or landings in the area (DFO 2009d). Although there is no known importance of the area for juvenile fish species, there are extensive eelgrass beds in Glace Bay Lake which may serve as an important nursery area. Dense rockweed, Irish moss, and kelp beds provide a source of primary production to the area (Moore *et al.1986*).

The area has lobster beds (Schaefer *et al.* 2004). Other species recorded include mackerel, dogfish (Highland Coastal Mapping Association 2001), and urchins in high densities (Moore *et al.* 1986).

There are two SARA-listed species in the area: Atlantic wolffish (special concern) (Schaefer *et al.* 2004) and Piping Plover (endangered) (IBA Canada 2009). Atlantic cod (endangered, COSEWIC) is also found in the area (Schaefer *et al.* 2004; King 2004).

The area is considered to have a medium degree of naturalness and high resilience (Doherty and Horsman 2007).

Bird Information

This area's boundaries coincide closely with those of the Big Glace Bay IBA (Number NS007). Here, Canada Goose numbers can attain continental significance during the spring migration (BLI 2009). Other species using this area include gulls, terns, ducks, and shorebirds but numbers do not meet national significance thresholds. No seabird or waterbird colonies are located within the area boundaries. Along with very high numbers of geese, very high numbers of dabbling ducks can be found here. The area can host very high bay duck and high sea duck numbers (CWS).

Important Marine Ecological Features:

- Atlantic cod, herring, and capelin spawning area in adjacent waters
- Extensive eelgrass beds in Big Glace Bay Lake
- SARA-listed species: Atlantic wolffish (special concern) and Piping Plover (endangered)
- COSEWIC-assessed species: Atlantic cod (endangered)
- Abundance and diversity of marine algae
- Birds: IBA (1), eelgrass habitat, geese, dabbling ducks, bay ducks

Human Uses

Human uses of the area include coastal development, fishing, potential oil and gas development, and recreation.

Coastal Development

Although the surrounding population of Cape Breton Regional Municipality is high, the population is decreasing and coal mines and steel mills have closed. Water quality may therefore be improving. The surrounding Cape Breton Regional Municipality has a comprehensive municipal planning strategy and associated land use bylaws (see Appendix D) (CBCL Limited 2009).

There are few plans for industrial development in the area. There was a plan to re-dredge Glace Bay Harbour at the time of writing (CEAA 2008) which may affect the saline lake. There is a proposal to develop the Donkin coal mine, located near Big Glace Bay. The coal reserve is located 2 km offshore and 130 m below the Atlantic Ocean (Xstrata 2009). If a decision is made to proceed with the project, production could occur as early as 2011 (*Ibid.*).

The area may have potential for wind energy development, with high wind speeds of 7.51-8.0 m/s on surrounding land (Province of Nova Scotia 2010).

Commercial Fishing

DFO's MARFIS database (VDC 2009) does not indicate that any fisheries occurred in the immediate area from 2007-2009, DFO's Human Use Atlas (DFO 2005a) indicates that fisheries took place at low levels from 1999-2003 for redfish, herring, and mackerel in the general Glace Bay area, outside the EBSA boundaries (DFO 2005a).

Lobster landings in the area are also low. In grid square 352, the reporting unit that most closely aligns with the study area, 2008 lobster landings are estimated at 156 MT. These landings comprise 0.52% of 2008 landings in the Maritimes Region and 5.79% of LFA 27 landings in 2008. LFA 27 comprises 9.06% of 2008 landings in the Maritimes Region (VDC 2009).

Mackerel was potentially of higher importance than other species in past years. There are mackerel fisheries in both the inshore and offshore areas of Big Glace Bay, and Glace Bay is listed as an important mackerel port in Cape Breton (Schaefer *et al.* 2004), although no landings were recorded for 2007-2009 in the immediate area (VDC 2009). Herring is caught for bait and roe (Highland Coastal Mapping Association 2001). No detail is available on the redfish fishery other than there are minimal landings (DFO 2005a) and gear used includes longlines and trawls (VDC 2009).

Overall, landings in the area including and directly adjacent to Big Glace Bay are low for all species. The area has one small craft harbour and two fish processing plants (CCN 2006).

Table 4.37 below provides a summary of commercial fisheries near Big Glace Bay.

Table 4.37 Summary of Major Commercial Fisheries and Gear Used near Big Glace Bay

Species	Landings*	Gear	Year	Source
Lobster	L	Trap	2008	VDC 2009
Herring	L	N/A	1999-2003	DFO 2005a
Mackerel	L	N/A	1999-2003	DFO 2005a
Redfish	L	Trawl or longlines	1999-2003	DFO 2005a

*H = high, M = medium, L = low

Oil and Gas

The Hunt Oil Company of Canada Ltd. was issued license no. EL 2364 for oil and gas exploration and development. This license comprises a large portion of Western Sydney Bight and includes the Bird Islands (DFO 2001a). The impacts of oil and gas exploration in this area would be "amplified due to the small, shallow, enclosed nature of the environment and the high biomass and diversity year-round" (*Ibid.*). Seismic surveys were conducted in a large area approximately 25 km north of Big Glace Bay in 2005, during a period which was determined to have the lowest impact on migrating species (Hunt Oil Company of Canada Inc. 2005). There are no current petroleum interests in the area (Nova Scotia Energy 2009), however there is potential for further development.

Tourism, Recreation, and Culture

Glace Bay and the surrounding areas have a history tied to the coal mining industry which dates back to the early 1700s. In 1873 there were 8 coal companies operating in Glace Bay (Cape Breton Miners' Museum 2009). Since the decline of the coal mining industry which resulted in severe job losses, fishing became important to the local economy until Atlantic cod stocks collapsed. Cape Breton as a whole is experiencing population decline due to the downturn of the local economy.

Glace Bay has tourism facilities including Bed and Breakfasts, several restaurants, three museums, a theatre, and a golf and country club (although this is closer to Sydney). There are also cultural features such as the Marconi National Historic Site on the west side of Glace Bay (CCN 2006).

Motor vehicles (ATVs) are allowed access to the beach and pose a threat to the sensitive coastal features and bird habitat (BSC 2009).

Current Protection and Research/Conservation Initiatives

Big Glace Bay Lake is currently protected as a MBS, a Protected Beach under Nova Scotia's *Beaches Act*, and an IBA (see Figure 4.65).

There are no known conservation initiatives in the area and there is no current marine research taking place.

Summary

Table 4.38 below summarizes the key information provided in the site profile. Although little marine information is known for Big Glace Bay, the area is significant for birds and may be important for other species such as herring and cod that spawn in the area. There is potential that a sub-sea coal mine will be developed which may affect the marine and terrestrial ecology. The ecological attributes meet three of the *Oceans Act* criteria for MPA establishment, however there are provincial protection measures in place for the area.

Table 4.38 Summary of the Big Glace Bay Site Profile

***Oceans Act* Criteria**	**Ecological Attributes**	**Human Uses**	**Current Protection and Research Initiatives**
(a) The conservation and protection of commercial and non-commercial fishery resources, including marine mammals, and their habitats; (b) The conservation and protection of endangered or threatened marine species, and their habitats (d) The conservation and protection of marine areas of high biodiversity or biological productivity	• Atlantic cod, herring, and capelin spawning area • Extensive eelgrass beds in Big Glace Bay Lake • Abundance and diversity of marine algae • SARA species: Atlantic wolffish and Piping Plover • COSEWIC species: Atlantic cod • Birds: IBA (1), eelgrass habitat, geese, dabbling ducks, bay ducks	• Fishing - lobster - mackerel - redfish - herring • Potential development of a sub-sea coal mine • Potential oil and gas activity in offshore area • High level of coastal development • Some tourism • Destructive recreation: use of ATVs on important habitat	• Overlapping protection of the intertidal area • Current marine data are lacking

4.20 Western Sydney Bight

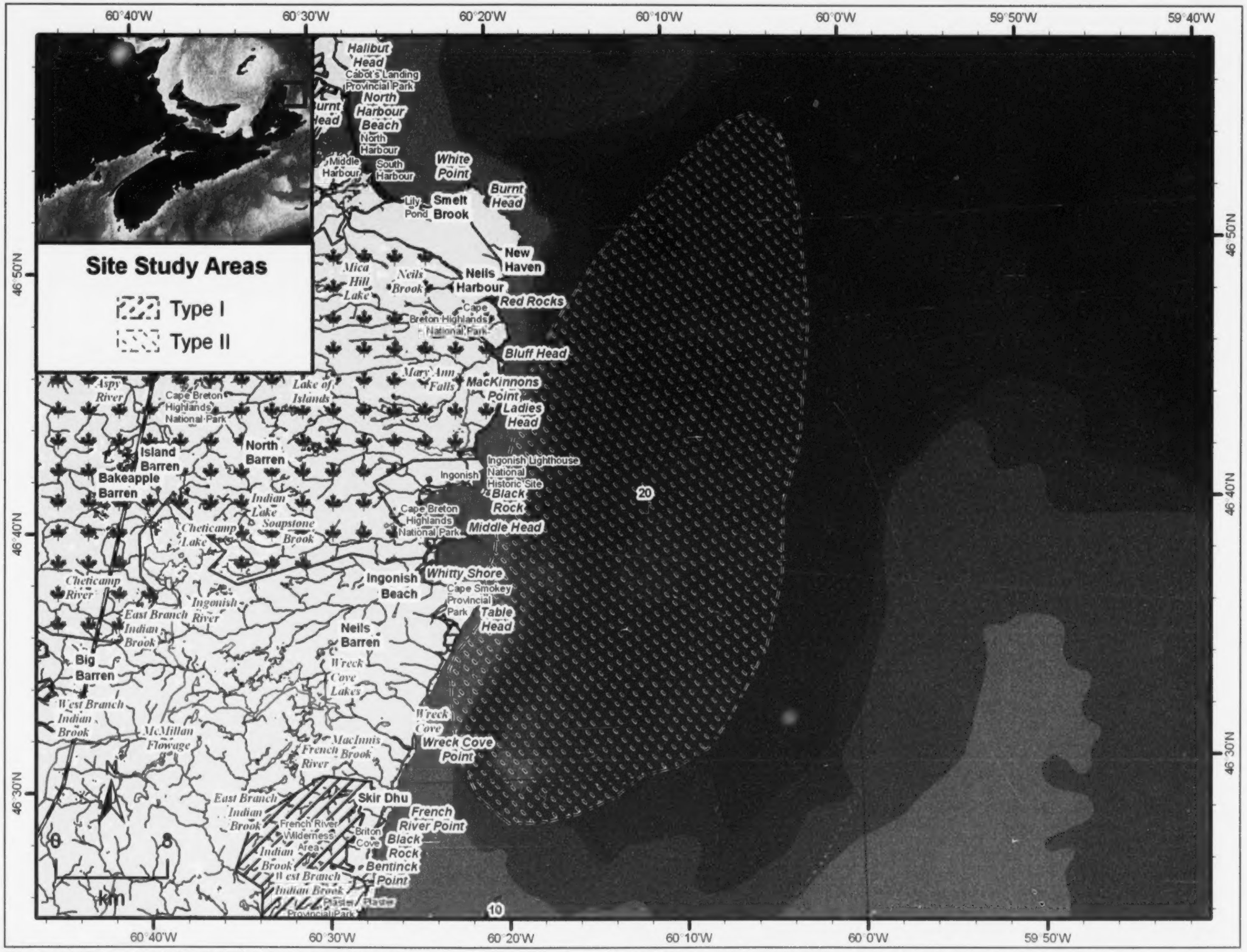
Western Sydney Bight is a marine area of high ecological importance that lies adjacent to Nova Scotia's highest elevations in Cape Breton Highlands National Park. The marine area has high species diversity and is important for several marine species at many stages of their lifecycles. It is particularly important for Atlantic cod which spawn, migrate and take refuge in the area. The area provides habitat for the endangered leatherback turtle (SARA) and the threatened winter skate (COSEWIC). The area is also of great importance to the fishing industry.

Location and Population

Western Sydney Bight is a large area adjacent to the coast of Victoria County stretching offshore from Aspy Bay in the north to French River in the south. The study area is 850.9 km^2 and extends approximately 20 km offshore just north of the Bird Islands. See Figure 4.67 for a location map of Western Sydney Bight. Victoria County has the lowest population in Nova Scotia, and has an overall population density of 0-10 people per km^2 with a higher density around Ingonish of 20-140 people per km^2 (Municipal Services 2001). The Ingonish area refers to a cluster of 5 communities along the Cabot Trail that occur along North and South Ingonish Bays (Moran Dan Productions 2009).

Physical and Oceanographic Attributes

Western Sydney Bight is deeper than other areas of Sydney Bight with depths over 100m in the offshore extent of the study area. Igneous rocks make up the seabed where the Cape Breton Highlands extend into the sea (Davis and Browne 1996b). The bottom is made up of sand, cobble, and exposed bedrock. There are a few beaches in the coastal area, the sediment of which is a result of coastal erosion (*Ibid.*). In summer months the waters are warmed by the Gulf of St. Lawrence and are cooler in winter due to exposure of sea ice which is transported out of the Gulf of St. Lawrence. Due to the rugged rocky coastline, there are few sensitive coastal habitats such as wetlands, but there are a few barrier beaches in some of the embayments (*Ibid.*). Figure 4.68 illustrates some of the coastal features around Ingonish Beach. The terrain is made up of coastal barrens and lush green valleys (Moran Dan Productions 2009). The area has a low to moderate sensitivity to sea level rise due to higher elevations (NRCan 2007). The maximum depth of the study area is 183 m (CHS Chart 4022).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Site Study Areas
Type I
Type II
Halibut Head
Cabot's Landing Provincial Park
North Harbour Beach
North Harbour
Burnt Head
Middle Harbour
South Harbour
White Point
Smelt Brook
Lily Pond
Burnt Head
New Haven
Neils Harbour
Neils Brook
Mica Hill Lake
Red Rocks
Cape Breton Highlands National Park
Bluff Head
Mary Ann Falls
MacKinnons Point
Ladies Head
Lake of Islands
Aspy River
Island Barren
Bakeapple Barren
North Barren
Ingonish
Ingonish Lighthouse National Historic Site
Black Rock
Middle Head
Indian Lake
Soapstone Brook
Cheticamp Lake
Cheticamp River
Ingonish River
Ingonish Beach
Whitty Shore
Cape Smokey Provincial Park
Table Head
East Branch Indian Brook
Neils Barren
Big Barren
Wreck Cove Lakes
West Branch Indian Brook
McMillan Flowage
Wreck Cove
Wreck Cove Point
MacInnis Brook
French River
Skir Dhu
East Branch Indian Brook
French River Wilderness Area
Briton Cove
French River Point
Black Rock
Bentinck Point
Indian Brook
West Branch Indian Brook
Plaster Provincial Park
20
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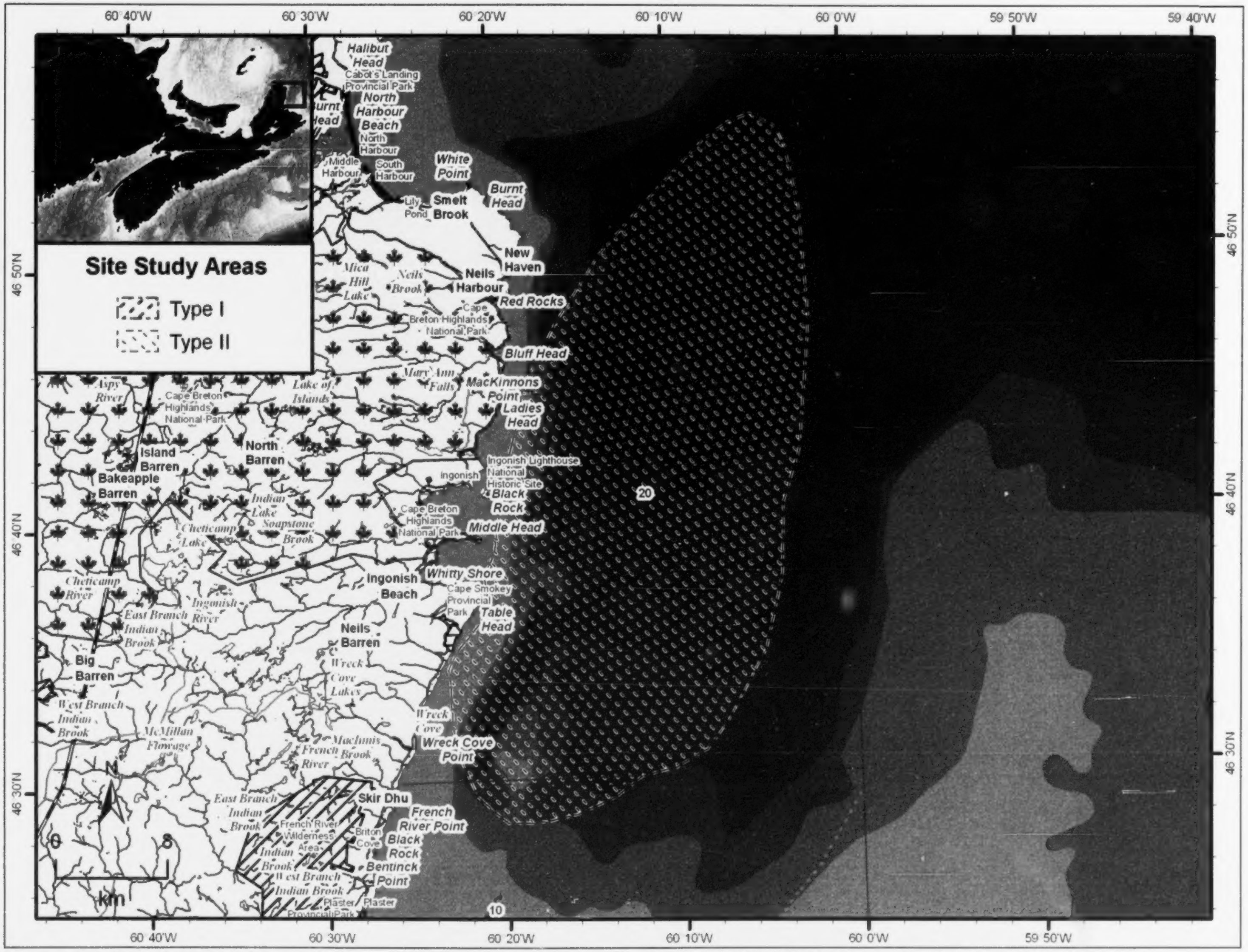
Figure 4.67 Location Map for Western Sydney Bight (Site #20). Basemap layers: land 1: 50 000, 1: 250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); Restricted and Limited Use Land Database Layers (NSDNR 2006b). Refer to Figure 4.1 for legend.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Neils Brook
Neils Harbour
Red Rocks
Cape Breton Highlands National Park
Bluff Head
Mary Ann Falls
MacKinnons Point
Ladies Head
Aspy River
Lake of Islands
Island Barren
North Barren
Bakeapple Barren
Ingonish
Ingonish Lighthouse National Historic Site
Black Rock
Indian Lake
Soapstone Brook
Cheticamp Lake
Middle Head
Cheticamp River
Ingonish River
Ingonish Beach
Whitty Shore
Cape Smokey Provincial Park
Table Head
East Branch Indian Brook
Neils Barren
Big Barren
Wreck Cove Lakes
West Branch Indian Brook
McMillan Flowage
Wreck Cove
Wreck Cove Point
Machmis Brook
French River
East Branch Indian Brook
Skir Dhu
French River Wilderness Area
Briton Cove
French River Point
Black Rock
Bentinck Point
Indian Brook
West Branch Indian Brook
Plaster Provincial Park
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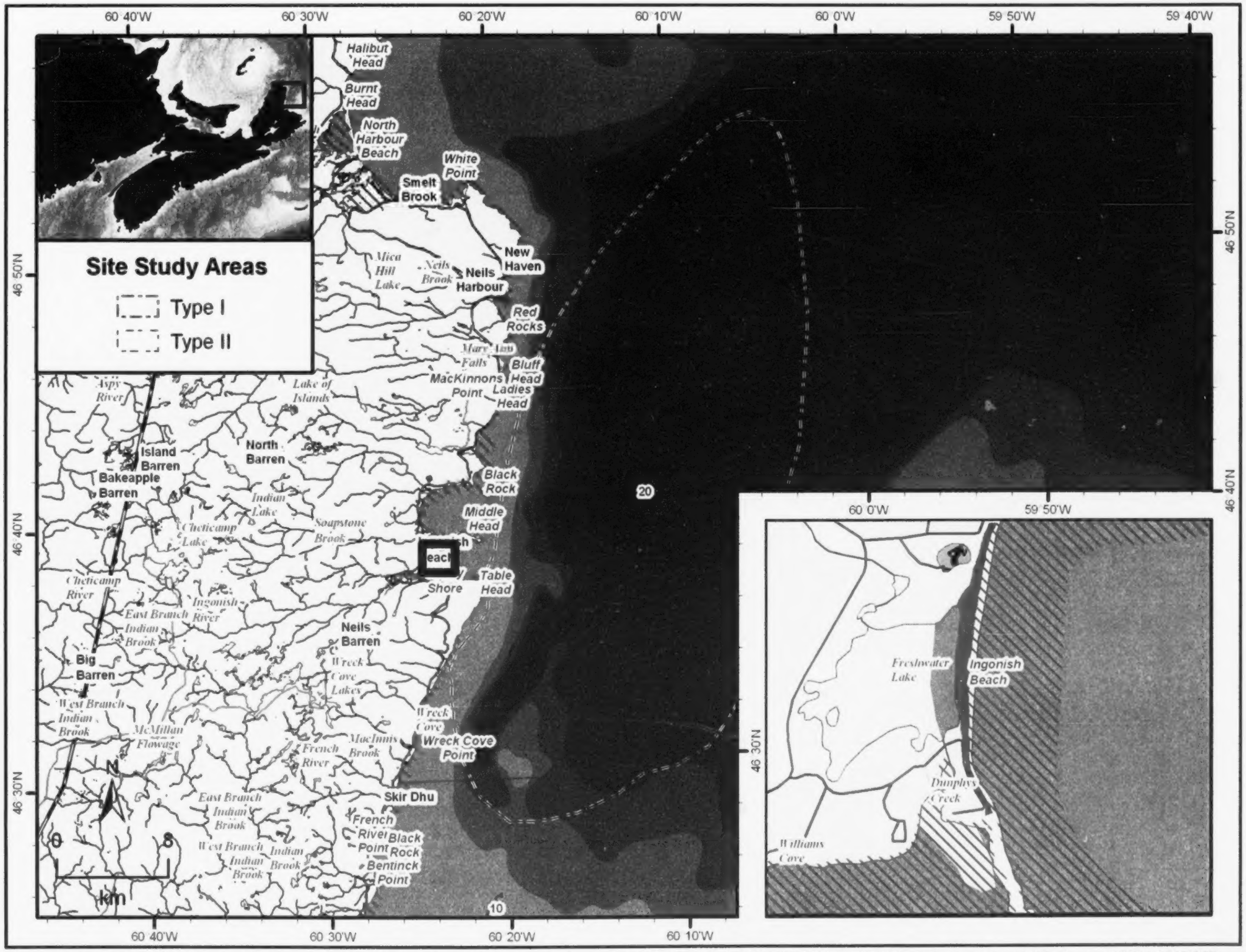
Figure 4.67 Location Map for Western Sydney Bight (Site #20). Basemap layers: land 1: 50 000, 1: 250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); Restricted and Limited Use Land Database Layers (NSDNR 2006b). Refer to Figure 4.1 for legend.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Neils Harbour
Red Rocks
Mary Ann Falls
Bluff Head
MacKinnons Point
Ladies Head
Aspy River
Lake of Islands
Island Barren
North Barren
Bakeapple Barren
Black Rock
Indian Lake
Middle Head
Cheticamp Lake
Soapstone Brook
Shore
Table Head
Cheticamp River
Ingonish River
East Branch Indian Brook
Neils Barren
Big Barren
Wreck Cove Lakes
West Branch Indian Brook
McMillan Flowage
Wreck Cove
Wreck Cove Point
MacInnis Brook
French River
Skir Dhu
East Branch Indian Brook
French River Point
Black Rock
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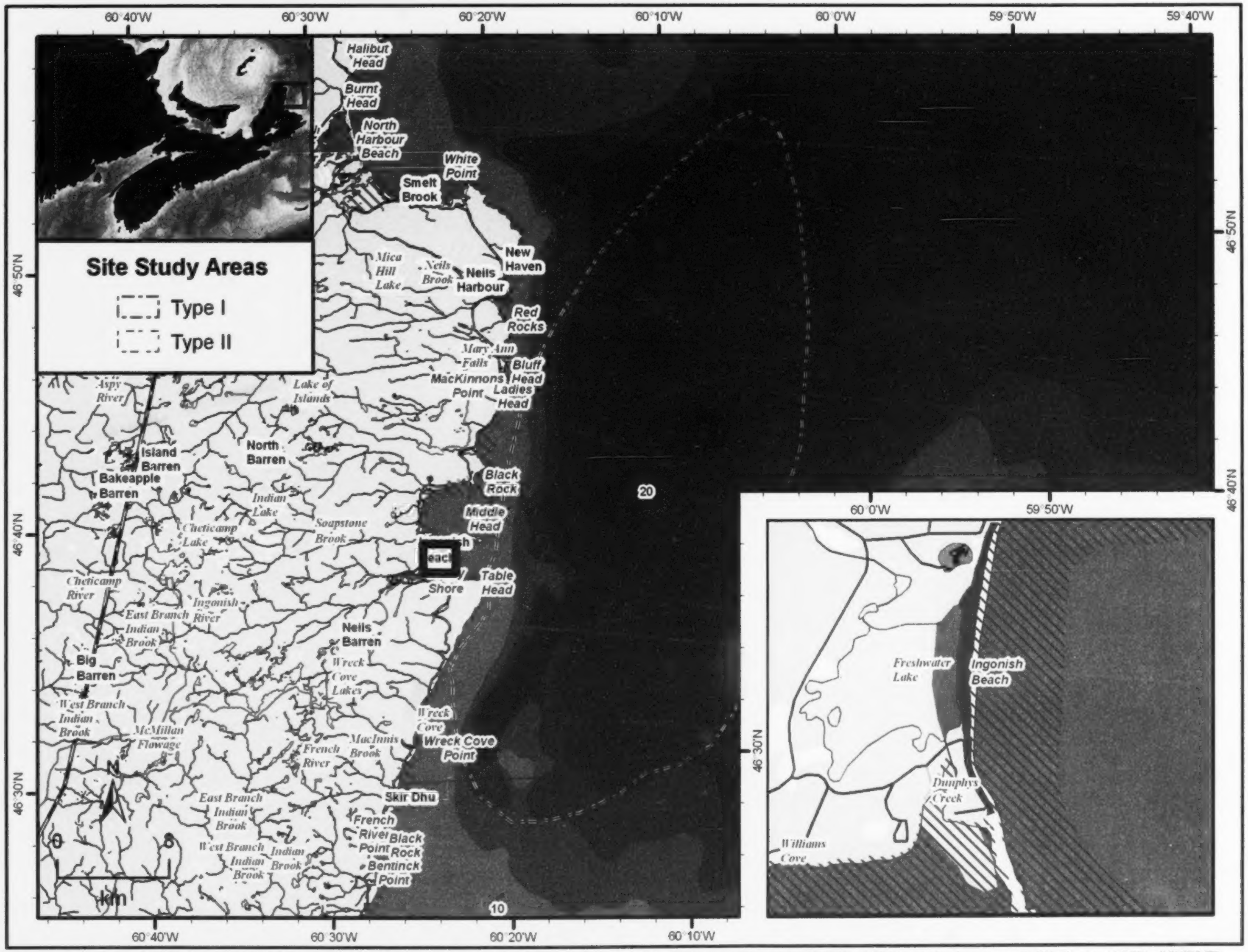
Freshwater Lake
Ingonish Beach
Dunphys Creek
Williams Cove

Figure 4.68 Coastal Habitats near Western Sydney Bight (Site #20). Basemap layers: land 1:50 000, 1:250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); NSDNR Wetlands Database layers (NSDNR 2000). Refer to Figure 4.2 for legend.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Soapstone Brook
Shore
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Cheticamp River
Ingonish River
East Branch Indian Brook
Neils Barren
Big Barren
Wreck Cove Lakes
West Branch Indian Brook
McMillan Flowage
Wreck Cove
Wreck Cove Point
MacInnis Brook
French River
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East Branch Indian Brook
Skir Dhu
French River Point
Black Rock
Bentinck Point
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Freshwater Lake
Ingonish Beach
Dunphys Creek
Williams Cove

Figure 4.68 Coastal Habitats near Western Sydney Bight (Site #20). Basemap layers: land 1:50 000, 1:250 000 NTDB (NRCan); bathymetry S-57 charts (CHS); NSDNR Wetlands Database layers (NSDNR 2000). Refer to Figure 4.2 for legend.

Ecological Attributes

Western Sydney Bight was identified by scientific experts as an EBSA. It meets all EBSA criteria. Most of the area was identified 1-2 times by scientific experts and the area surrounding Stanley Point was identified 3 times in the EBSA identification process (Doherty and Horsman 2007).

Sydney Bight as a whole is very ecologically significant, with high biodiversity, high concentrations of marine species, spawning and nursery areas, and provides home to several marine SARA-listed and COSEWIC-assessed species. Western Sydney Bight shares these characteristics (Schaefer *et al.* 2004).

The area is an important spawning area for Atlantic cod (Bundy *et al.* 2007; Doherty and Horsman 2007; King 2004), American plaice, and capelin (Schaefer *et al.* 2004). The area may have once been a herring spawning area (*Ibid.*), however, it was not identified as a herring spawning area in the 2009 Assessment of 4VWX herring (DFO 2009d). It is important for juvenile cod (Bundy *et al.* 2007; Schaefer *et al.* 2004; Doherty and Horsman 2007; King 2004), and planktonic stages of witch flounder, redfish, plaice, lobster, rock, snow, Jonah and toad crab (Schaefer *et al.* 2004). Sydney Bight is known as an important overwintering area for migratory populations of Atlantic cod, plaice, white hake, witch flounder, redfish and herring (Schaefer *et al.* 2004).

The area has high concentrations of snow crab, extensive lobster bottom, scallop bottom (Schaefer *et al.* 2004), and several other aggregations. The area may be important for whales. The Cabot Strait is a migration route for whales entering the Gulf of St. Lawrence including blue, fin, and humpback whales. Pilot and minke whales and harbour porpoises may also be found in the area (Schaefer *et al.* 2004).

Several SARA-listed and COSEWIC-assessed species are found in the area including the endangered leatherback turtle (SARA), winter skate (threatened, COSEWIC), Atlantic cod (endangered, COSEWIC) at all age groups, Atlantic wolffish (special concern, SARA), and the fin whale (special concern, SARA) (Schaefer *et al.* 2004; King 2004).

Although the area is not a suitable habitat for eelgrass or salt marshes, extensive and diverse marine algae (Moore *et al.*1986) are a source of primary productivity. Western Sydney Bight is an area of high biodiversity with high benthic and pelagic conservation value (King 2004).

This site met the EBSA criteria for naturalness to an unspecified degree (Doherty and Horsman 2007).

Bird Information

This area does not coincide or otherwise overlap with presently identified IBAs. However, Ingonish Island IBA (Number NS055), adjacent to but not within the identified area, can host continentally if not globally significant numbers of Great Cormorants (BLI 2009). The few other colonies in the vicinity can host large numbers of Great Black-backed Gull, and modest numbers of Herring Gull, Common and Arctic Terns, but not reaching national significance. Geese are typically not detected here, and dabbling ducks occur only in low numbers. Though bay ducks generally do not occur here, the area is known to host high sea duck numbers (CWS).

Important Marine Ecological Features:

- Important Atlantic cod spawning area
- Spawning area for American plaice, herring, and capelin
- Important nursery area for cod and several other fish and invertebrates, especially snow crab
- Overwintering area for migratory populations of Atlantic cod, plaice, white hake, witch flounder, redfish and herring
- High biodiversity and highly productive area
- Important area for cetaceans
- SARA-listed species: fin whales (special concern), Atlantic wolffish (special concern) and leatherback turtle (endangered)
- COSEWIC-assessed species: Atlantic cod (endangered) and winter skate (threatened)

Human Uses

The most significant human use in Western Sydney Bight is fishing, followed by potential oil and gas development. There is coastal development around Ingonish, but the area has a low population density and therefore minimal development, however there are industrial developments in the Great Bras d'Or Channel. There are no aquaculture licenses in the study area (Service Nova Scotia 2008).

Coastal Development

Although not immediately adjacent to the study area, there is potential for heavy industry to affect the area. In the Great Bras d'Or Channel there are active mines for limestone and there were two active coal mines at Point Aconi in 2000 but they are no longer active (Fisher and Wenning 2008). The Point Aconi power station discharges copper and cooling water into the Sydney Bight area (Schaefer *et al.* 2004). These developments have likely resulted in an increase in shipping traffic.

The surrounding area does not have a comprehensive municipal planning strategy and associated land use bylaws (see Appendix D) (CBCL Limited 2009).

Commercial Fishing

Sydney Bight is a known area of importance for commercial fisheries. The area is most important for mackerel, snow crab, and grey sole/witch flounder but also has moderate landings of herring and lobster (VDC 2009; DFO 2005a). Groundfish landings are low in the area and include Atlantic cod, redfish, and Atlantic halibut (DFO 2005a).

Snow crab and grey sole landings are in the centre of the study area, further from shore, whereas mackerel and herring landings are primarily caught inshore near Ingonish (VDC 2009). There was also a small amount of scallop, silver hake, and other crabs caught in past years (DFO 2005a), but quantities are minimal. Sand and blood worm harvesting occurs in Ingonish Harbour, in the coastal area of Western Sydney Bight (Bundy *et al.* 2007).

Lobster landings in this area are moderate. In grid square 357, 358, 359 the reporting units that most closely align with the study area, 2008 lobster landings are estimated at 443 MT. These landings comprise 1.49% of 2008 landings in the Maritimes Region and 16.43% of LFA 27 landings in 2008. LFA 27 comprises 9.06% of 2008 landings in the Maritimes Region (VDC 2009).

Much of the fishing activity is conducted using fixed gear, especially in areas closer to the coast where mackerel and herring are caught. Snow crab and lobster are other major fisheries in the area and are caught using fixed gear (traps) (VDC 2009). There is also some rock crab fishing out of Ingonish, Ingonish Beach, and Little River but landings are minimal (M. Eagles, DFO Oceans, Habitat and Species at Risk Branch, pers. comm. 2010).

There are eight fishing wharves and two fish processing plants in the area (CCN 2006). Table 4.39 provides a summary of commercial fisheries in Western Sydney Bight.

Table 4.39 Summary of Major Commercial Fisheries and Gear Used in and Adjacent to the Western Sydney Bight Area

Species	**Landings***	**Gear**	**Year**	**Source**
Lobster	M	Trap	2008	VDC 2009
Mackerel	M	Trap net	1999-2003 2007-2009	DFO 2005a VDC 2009
Snow crab	M	Trap	1999-2003 2007-2009	DFO 2005a VDC 2009
Herring	L	Trap net	2007-2009	VDC 2009
Grey sole/witch flounder	M-H	Danish seine	1999-2003 2007-2009	DFO 2005a VDC 2009
Groundfish	L	Longline and trawl	1999-2003	DFO 2005a

*H = high, M = medium, L = low

Oil and Gas

The Hunt Oil Company of Canada Ltd. was issued license no. EL 2364 for oil and gas exploration and development. This lease comprises a large portion of Western Sydney Bight and also includes the Bird Islands (DFO 2001a). The impacts of oil and gas exploration in this area would be "amplified due to the small, shallow, enclosed nature of the environment and the high biomass and diversity year-round" (*Ibid.*). Seismic surveys were conducted in a large area which included Western Sydney Bight in 2005, during a period which was determined to impact migrating species the least (Hunt Oil Company of Canada Inc. 2005). There are no current petroleum interests in the area (Nova Scotia Energy 2009), however there is potential for further development.

Tourism, Recreation, and Culture

There are numerous ecotourism opportunities in the coastal area of Western Sydney Bight. These include hiking, camping, kayaking, whale and bird watching, and swimming. The Cape Breton Highlands National Park, Cape Smokey Provincial Park, and Ingonish area draw in numerous tourists to take part in these activities along the scenic Cabot Trail. Tourist facilities in the area include several accommodation types such as cottages, resorts, a motel, and campgrounds (CCN 2006). There are also three whale watching operators out of Ingonish and there is whale watching and kayaking out of Englishtown (*Ibid.*).

There are several cultural festivals, including Ceilidhs and other traditional Cape Breton Activities which occur in summer months in Ingonish (Moran Dan Productions 2009).

Current Protection and Research/Conservation Initiatives

There are several protected areas on the land near Western Sydney Bight which include the Cape Breton Highlands National Park, Cape Smokey Provincial Park, Plaster Provincial Park & Plaster Non-designated Park or Park Reserve, and the French River Wilderness Area which is near the coast (NSDNR 2006b; Service Nova Scotia 2006). Ingonish Island is an IBA (BSC 2009), as previously mentioned.

Research was recently completed in the area including LEK mapping of significant habitats and fishery-independent research which involved transect sampling of nine sites in Nova Scotia, one of which is in Northern Cape Breton, near the coast of Western Sydney Bight (Bundy 2007 *In* DFO 2007c).

Sydney Bight was recognized as a preliminary ecological priority area in the Scotian-Shelf Bay of Fundy region in DFO's preliminary offshore MPA network planning (DFO 2009b). A larger site comprising all of Sydney Bight was assessed using the methodology applied in the offshore (MARXAN analysis) and this smaller area of Western Sydney Bight is being assessed as part of this initiative for coastal conservation planning.

Although there are no current research initiatives specific to the study area, trawl survey data is available for the area which was used to identify Sydney Bight as a preliminary ecological priority area in the MARXAN analysis.

Summary

Table 4.40 below summarizes the key information provided in the site profile. Western Sydney Bight is a highly productive environment with many important ecological attributes that are recognized by other federal and provincial government departments. The ecological attributes align with all of the *Oceans Act* criteria for MPA establishment.

Table 4.40 Summary of the Western Sydney Bight Site Profile

***Oceans Act* Criteria**	**Ecological Attributes**	**Human Uses**	**Current Protection and Research Initiatives**
(a) The conservation and protection of commercial and non-commercial fishery resources, including marine mammals, and their habitats; (b) The conservation and protection of endangered or threatened marine species, and their habitats (c) The conservation and protection of unique habitats; (d) The conservation and protection of marine areas of high biodiversity or biological productivity	• Important Atlantic cod spawning area • Spawning area for American plaice, herring, and capelin • Important nursery area for cod and several other fish and invertebrates, especially snow crab • Overwintering area for migratory populations of Atlantic cod, plaice, white hake, witch flounder, redfish, and herring • High biodiversity and highly productive area • Important area for cetaceans • SARA species: fin whale, Atlantic wolffish and leatherback turtle • COSEWIC species: Atlantic cod and winter skate	• Fishing - lobster - mackerel - snow crab - groundfish - herring - grey sole/witch - flounder • Some tourism and recreation inshore • Low level of coastal development • Potential for oil and gas activity in offshore	• Terrestrial protection in adjacent terrestrial area • Current research: IEP (LEK mapping and fishery-independent surveys) • Recognized as preliminary priority site in proposed offshore MPA network

5.0 Potential Ecosystem Impacts of Human Uses

The purpose of this section is to provide a general overview of the existing and potential impacts on coastal and marine ecosystems that can result from the various human activities occurring with the twenty site profiles described in Section 4.0. Impacts listed below include coastal development, fisheries, aquaculture, oil and gas, other energy sources, transportation and shipping, and tourism and recreation. The potential impacts described in this section are not exhaustive. Other activities that may impact the marine environment include non-point sources of pollution from forestry, agriculture, and other activities which occur within watersheds that connect with the marine environment.

Impacts often differ depending on their intensity and on the sensitivities of specific ecosystem features and processes within a given area. In most cases, the specific impacts on the marine environment from human activities are unknown or poorly understood. Addressing this knowledge gap should be a priority area of research in the future. This research should aim to identify threats, quantify specific impacts, and identify the ecosystem and habitat features that are sensitive to the threats within a given area. State of the environment reporting is an important management tool which can help to improve our understanding of how human activities have impacted the marine environment and to identify key information gaps for future monitoring and research. Recently, a number of organizations and governments have released state of the environment reports on the coastal and ocean environment in Nova Scotia including the Gulf of Maine Council on the Marine Environment and the Government of Nova Scotia (Gulf of Maine Council on the Marine Environment 2010; CBCL Ltd. 2009).

Despite the uncertainty regarding the specific impacts of human activities on marine and coastal ecosystems, it is commonly accepted that ecosystem impacts are occurring (DFO 2010c). For example, key findings from the *2010 Canadian Marine Ecosystem Status and Trends Report* for the Gulf of Maine and Scotian Shelf include a major shift in ecosystem structure that has impacted all trophic levels, a decline in the size and condition in a number of groundfish species, impacts from bottom contact fishing, and cumulative impacts from activities in the coastal zone, namely aquaculture and habitat alteration (DFO 2010c).

Coastal Development

Coastal development is often associated with many of the human uses described within this section (*e.g.* fisheries, shipping). Residential, commercial, and industrial development can pose direct and indirect threats to marine ecosystems. Poorly planned development can cause pollution to marine environments including organic and inorganic pollutants from sewage outfalls and agricultural runoff which can cause eutrophication (Halpern *et al.* 2009). Point and non-point source pollution from urban and rural development can cause beach closures as well as commercial and recreational shellfish harvesting closures due to unsafe contaminant levels (Stewart *et al.* 2003). Industrial development can produce effluent containing heavy metals, volatile organic compounds, polychlorinated biphenyls (PCBs) and other contaminants that degrade ecosystems and present risks to human health. Construction near waterways and dredging operations can cause direct habitat loss and alteration and indirect habitat disturbance through sedimentation (Stewart *et al.* 2003; Maragos 1993). Shoreline stabilization can disrupt natural sedimentation processes, potentially affecting coastal habitats (Maragos 1993) such as salt marshes which are important for several species, including fish and waterfowl, and are one of the most productive ecosystems in the world (Stewart *et al.* 2003). These impacts are amplified by high population densities in coastal areas that result in cumulative impacts to coastal ecosystems (Halpern *et al.* 2009). Many of these pressures and impacts are noted in the *2010*

Canadian Marine Ecosystem Status and Trends Report (DFO 2010) and the State of the Gulf of Maine Report: Coastal Ecosystems and Habitats (Gustavson 2010).

Fisheries

In the absence of ecosystem-based management fishing may impact coastal and marine ecosystems and habitats. Commercial overexploitation has caused the decline of many fish stocks on both the Atlantic and Pacific coasts (DFO 2010c). Some fishing practices can impact biodiversity (Worm *et al.* 2006) by causing high levels of incidental mortality (Donaldson *et al.* 2010; Fuller *et al.* 2008) and some fisheries can cause the entanglement of cetaceans, marine turtles, and large pelagics (Donaldson *et al.* 2010). A key concern is habitat alteration from the physical interaction of fishing gear with benthic habitats (DFO 2006b; Donaldson *et al.* 2010; Fuller *et al.* 2008) if effective conservation measures are not practiced. Mobile bottom fishing gear can impact benthic populations and communities by changing population and community structure and composition and can impact habitats by damaging or reducing structural biota and habitat complexity (DFO 2006b), however, there is limited mobile gear activity in coastal areas of Nova Scotia. Fixed benthic gear can impact the benthic habitats in more localized areas (Donaldson *et al.* 2010). The extent of these impacts varies according to the benthic communities present and level of activity. Sensitive benthic areas in the coastal zone of Nova Scotia include macrophyte beds which are typically more vulnerable to the impacts of fishing gear. Potential fishing gear impacts within vulnerable benthic areas will be addressed in the implementation of DFO's *Policy for Managing the Impacts of Fishing on Sensitive Benthic Areas* (DFO 2009i). Some of these impacts can be reduced by fisheries management measures including fisheries closures, use of low-impact gear such as traps used in lobster and crab fisheries and gear modifications to reduce incidental mortality.

Aquaculture

There are several studies that demonstrate the impacts of salmon aquaculture on wild salmon stocks including diseases which have spread from farming operations to wild stocks and farmed escapees which compete with wild stocks. A study by Ford and Myers (2008) demonstrates a 50% reduction (average) in survival and abundance of wild salmon near salmon aquaculture operations in Scotland, Ireland, Pacific Canada, and Atlantic Canada.

Other effects of aquaculture are described in a Canadian Science Advisory Secretariat Science Advisory Report: *Pathways of Effects for Finfish and Shellfish Aquaculture* (DFO 2010b). Chemicals enter the environment during normal aquaculture practices either directly as pesticides, antifoulants and disinfectants or in faeces and constituents of medicated food, however, data on the effects of chemical contamination is limited (*Ibid.*). There is scientific evidence that bivalve and finfish aquaculture can affect nutrient flow in both pelagic and benthic environments (*Ibid).* There are several oceanographic, biological, chemical and physical characteristics of the receiving environment as well as other factors that influence the pathways of effects for aquaculture operations (*Ibid*). There are several knowledge gaps in identifying some of the key stressor-effect linkages (*Ibid*).

Oil and Gas

Although oil and gas activities primarily occur offshore, some of the sites within this report are found near areas where seismic surveying occurred (the Bird Islands and Western Sydney Bight). There are no immediate threats of oil and gas impacts on the coastal zone, as the only operations in Nova Scotia occur offshore. Potential impacts from oil and gas activities may reach coastal areas, even when activities occur further offshore. Little is known about the effects of seismic testing on larvae and eggs of many fish and jellyfish species, however, sub-lethal effects may occur at high levels of exposure (DFO 2001a, DFO 2004b). Marine mammals are highly sensitive to seismic testing, however it is unknown if effects are chronic or acute and how far they occur from the sound source (*Ibid.*). Drilling muds and cuttings which are discharged into the marine environment can smother benthic habitats and species, cause contamination, and disrupt biological functions of marine organisms (*Ibid.*). The accidental release of contaminant hydrocarbons may cause mortality to marine species, particularly for eggs, larvae and juveniles (*Ibid.*). The discharge of drilling muds and cuttings and the accidental release of contaminant hydrocarbons are more likely to occur offshore than in coastal areas. Other potential impacts include habitat disruption from infrastructure and various potential impacts due to increased vessel traffic (*Ibid.*). Although the risk and consequences of the aforementioned impacts are relatively low due to the lack of activity in the coastal zone, the consequence of an oil spill is extremely high. Oil spills can be far-ranging and cause significant damage to marine life and marine habitats as well as impacts on tourism and commercial fisheries, as witnessed in the Deepwater Horizon spill in the Gulf of Mexico.

Other Energy Sources

Other forms of energy production such as tidal energy and offshore wind energy may impact marine and coastal environments. A recent publication by DFO's Canadian Science Advisory Secretariat (DFO 2009h) states: "tidal in-stream energy conversion and wave energy conversion technologies have the potential to result in changes to current flows, wave exposure, and associated sediment and coastal processes that could have direct and indirect effects on marine and coastal ecosystems". However, the report also states that the extent of the effect of any project depends on a several variables including the technology characteristics, project scale, distance from the coast, and natural coastal structure and processes (hydrodynamic and sedimentary) (DFO 2009h). There are no current proposals in the study area for these types of energy developments, however the Province of Nova Scotia is currently consulting on a background paper for the development of a new Marine Renewable Energy Legislation (Nova Scotia Energy 2010).

Transportation and Shipping

Transportation and shipping can impact marine environments with the introduction of invasive species through ballast water exchange and pollution caused by discharges to water including oil, oily water, sewage, garbage, grey water, and cargo (liquid or dry) (Transport Canada 2009). Shipping can also impact marine mammals by ship strikes. In the coastal environment shipping and transportation impacts are predominantly pollution caused by discharges to water and invasive species introductions. The deeper waters off the coastal zone of Nova Scotia has significant levels of shipping activity with traffic to and from various ports such as Halifax and Sydney.

Tourism and Recreation

Tourism and recreation can affect coastal ecosystems if not properly managed. Tourism can be associated with an increase in coastal development. Tourism activities as well as increased development can result in physical damage to habitat, pollution of sensitive habitats, and impacts directly to species including species at risk (*e.g.* through recreational activities such as hunting and ATV use in unprotected areas where sensitive species and habitats occur). High densities of tourists and frequent visits to significant habitats could disrupt individual species or populations.

Addressing Potential Impacts of Human Uses

Gustavson (2010) and DFO (2010c) note that many coastal ecosystems and habitats are deteriorating in extent and condition due to a variety of impacts. There are a variety of management measures that can be used to address the impacts, depending on the conservation needs within a given area. MPAs are one tool of many that may address these impacts, but are not necessarily the most appropriate tool and specifically cannot address land-based impacts. Many of the impacts are best addressed within broader integrated coastal and ocean management frameworks and strategies for coastal planning (such as the Nova Scotia Coastal Strategy in development) which include a suite of management measures such as buffer zones, coastal development set backs, and sector based management measures including fisheries restrictions and best practices (Stewart *et al.* 2003).

The 20 sites reviewed in this report include both areas of high use and lower use and as such are not equally facing the impacts described above. The full extent of human uses and sensitive coastal ecosystems and habitats in Nova Scotia should be mapped to identify areas at higher risk of ecosystem disturbance from both marine and terrestrial human uses. It is also important to identify areas with low levels of human uses which may present opportunities to preserve areas that are relatively pristine.

6.0 Data and Information Gaps

6.1 Data and Information Gaps

There are overall data and information gaps throughout the study area and differences in data availability between areas. A great deal of the available information is outdated and therefore may not provide an accurate representation of the ecological features of specific areas. However, older information is important for determining areas that were productive in the past and may help to identify areas with potential for restoration. Older information could also be indicative of the current state of the sites where current information is lacking and is therefore not discounted as viable information.

Gaps exist on a coast-wide scale but also differ from site to site. Observations of the author and findings in the Inshore Ecosystem Project (IEP) (DFO 2006a, 2007c) include the following data gaps on a coast-wide scale from Lobster Bay to Cape North:

- Habitat distribution and species associations
- Species composition, distribution, and abundance (non-commercial and commercial information needed; finer scale lobster distribution data needed)
- Juvenile fish assemblages: species inventory, associations with habitat/bay types
- Assessment of biodiversity
- Compilation of oceanographic data at the bay scale
- Productivity of inlets (primary and secondary)
- Marine mammal surveys are out of date (*e.g.* uncertainty of the importance of Chedabucto Bay as a feeding ground for fin whales)
- Systematic surveys of waders and shorebirds are lacking
- LEK is out of date and inconsistent

The time and resources it would consume to gather data on a fine scale along the entire Atlantic Coast would be tremendous and would result in a delay in management action for the protection and conservation of ecologically important areas. For the purposes of this work at this stage, a coast-wide research strategy would be less effective than selecting particular coastal areas, such as those identified in this report, in which data gaps could be addressed. It was also noted in the *DFO/FSRS Inshore Ecosystem Project data synthesis workshop* proceedings (2007) that small areas should be identified for intense research for initial surveys. Some of the above gaps are being addressed by work that was undertaken as part of the IEP (see the boxed feature on page 18). This is discussed in Section 6.2. Prioritizing sites in which to focus research efforts could be done on an opportunistic basis in which there is stakeholder support or interest in research within a given area. Prioritization could also occur where areas lack current information but have documented historical ecological significance.

The sites presented in this report have a varying level of ecological information. Some sites have several data gaps, others have fewer data gaps but lack current information, and some sites have research initiatives underway. Table 6.1 groups the twenty sites according to their level of information. Current research initiatives are discussed in Section 6.2 below.

Table 6.1 Extent of Ecosystem Information Available for Each Site

Several data gaps	**Fewer data gaps but information outdated**	**Fewer data gaps with current information and/or research underway**
7 – Eastern Shore Islands WMA 11 – St. Paul Island 13 – Port l'Hebert 16 – Taylor Head 17 – St. Marys River 18 – Janvrin Islands	1 – Lobster Bay 2 – Cape Sable Island 5 – Mahone Bay 14 – Cole Harbour 19 – Big Glace Bay	3 – Port Joli and Kejimkujik 4 – LaHave Estuary and Islands 6 – St. Margaret's Bay 8 – Canso Ledges 9 – Mira Bay and Scatarie Island 10 – Bird Islands 12 – Bras d'Or Lakes 15 – Chezzetcook to Jeddore Harbour 20 – Western Sydney Bight

6.2 Addressing Data and Information Gaps

Below are some of the research initiatives currently occurring within and outside the study area which may address some of the data and information gaps noted above. These initiatives are broken down into two categories: *Current Research Initiatives to Address Data Gaps* and *Further Recommendations for Addressing Data and Information Gaps*. Table 6.2 at the end of this section summarizes the current research initiatives mentioned in this section, among others mentioned within the site profiles. Although the text below and Table 6.2 does not provide a comprehensive list of all current research initiatives in coastal Nova Scotia, this section highlights some of the initiatives that are most relevant to MPA planning and specifically to addressing data deficiencies in the marine environment.

Current Research Initiatives to Address Data Gaps

There are several research initiatives occurring within and outside the sites and the study area of this report, some of which are broader coastal initiatives covering larger areas and others that are site-specific. Some of these initiatives are highlighted in detail below in terms of how they may address the data gaps mentioned above, whereas others are mentioned in the site profiles and in the introductory portion of Section 4.0.

In addition to the initiatives mentioned in detail below, there are several other research initiatives underway, including a long-term Temperature Monitoring Program for coastal areas in the Maritimes Region and an Aquatic Invasive Species Progam. These programs are run out of DFO Science Branch and data and information provided from these programs should be considered in future conservation planning.

Inshore Ecosystem Project (IEP)

The LEK and Fishery-Independent surveys were components of a larger initiative of the DFO/FSRS IEP. Data collection is complete for both studies, however the data is currently undergoing analysis. Final results will provide valuable information for conservation planning and will address some of the aforementioned data gaps, particularly the need to update LEK surveys; species composition, distribution, and abundance; and assessments of biodiversity (DFO 2007c).

There are nine sites where these surveys have taken place, six of which are in this report: LaHave, the inshore area of Western Sydney Bight, Mira Bay, Chezzetcook, St. Margaret's Bay, and the Janvrin Island-Isle Madame area.

The objectives of the Fishery-Independent survey were to:

1. Develop baseline data for the inshore out to 12 miles/100 metres;
2. Identify and map the distribution of plants, benthic invertebrates, and fish along the coast of Nova Scotia out to 100 metres;
3. Explore latitudinal and inshore/offshore differences;
4. Capture marine biodiversity and habitat association; and
5. Identify potential EBSAs (to refine or confirm the EBSAs identified in the 2006 EBSA workshop).

(DFO 2007c)

The objective of the LEK survey was to "map fishermen's local knowledge of the distribution, seasonal changes in abundance, and life history and habitat associations of fish, invertebrates, birds, mammals, and macrophytes based on fishing histories and practices in the inshore ecosystem" (DFO 2007c).

Natural Geography Inshore Areas (NaGISA)

Port Joli and Canso are monitoring sites of the NaGISA project which is a project of the Census of Marine Life to develop a baseline for monitoring in nearshore environments using a series of standardized transects from the intertidal zone to depths of 20 m (NaGISA 2009). The major objective of NaGISA is to measure biodiversity in seagrass and rocky bottom algal habitats (NaGISA 2009).

NSDNR-DFO Eelgrass Project

The recent agreement between DFO's Oceans and Coastal Management Division and NSDNR's Wildlife Division to identify methods to monitor and map eelgrass is a means of addressing a significant data gap. Satellite imagery using RADARSAT-2 and Geo-Eye-1 imagery is being used as a means to map eelgrass in Port Joli and Musquodoboit Harbour. As satellite imagery is less effective at mapping habitats in deeper waters, especially in Nova Scotia due to the high turbidity of coastal waters (Vandermeulen 2007 *In* DFO 2007c), eelgrass distribution determined by satellite imagery could be complemented with methods to capture deepwater habitat features. The Towfish is an instrument that was developed by Herb Vandermeulen of DFO's Science Branch which is used to conduct transects using sidescan sonar and video that can be used to map benthic habitat composition and marine plant cover. The Towfish has been used to map other areas of Nova Scotia (including the Bras d'Or Lakes) but could be used to map the subtidal portion of Port Joli and Musquodoboit Harbour to complement the intertidal mapping that NSDNR is undertaking in these areas.

Further Recommendations for Addressing Data and Information Gaps

Coordinating Access to Data and Information

Although there are several coast-wide data gaps, gaining access to data and navigating through numerous websites to access information is a major challenge. A single web portal would allow for more efficient access to information for the management of coastal and ocean ecosystems. One such project is the COINAtlantic search utility which is being created to allow access to data and information on all coastal and ocean management initiatives in Atlantic Canada (COINAtlantic 2009). Of particular interest for conservation planning is habitat distribution. There are several efforts to map coastal habitats, such as NSDNR's wetland inventory, Davis and Browne's (1996b) Theme Regions for Nova Scotia including districts for the Atlantic Coast, and the Coastal Resources Mapping Projects that were led by DFO. Although some of this information requires updating, there is a current need to coordinate habitat distribution information from these various sources into one portal enabling users to view habitats geographically along the coast of Nova Scotia. This could be done through COINAtlantic, Service Nova Scotia and Municipal Relation's GEONova Portal, or NSDNR's current wetland inventory, building on information from other departments.

Community Aquatic Monitoring Program

DFO's Gulf Region is leading a coast-wide approach to enhance knowledge of coastal ecosystems in the Gulf of St. Lawrence that involves communities in the collection of coastal data to help monitor ecosystem health (DFO 2009g). This initiative, the Community Aquatic Monitoring Program (CAMP), "offers guidance for community based groups monitoring the health and marine productivity of their local water ecosystem. Through monitoring protocols with DFO, community groups are maintaining a science based approach program for health of watersheds throughout the Gulf Region" (*Ibid.*). Biological data are collected using beach seines to identify fish and crustacean species and to generate vegetation profiles of the areas sampled. Changes in community structure, among other ecosystem parameters, are assessed to inform management decisions and mitigate impacts (*Ibid.*). Universities and non-government organizations take part in CAMP and coordination is conducted by DFO. CAMP began in 2003 and coverage has since extended from northeastern New Brunswick to Mabou in Nova Scotia and all around Prince Edward Island (*Ibid.*). This initiative could be expanded to the Atlantic coast of Nova Scotia, not only to address data gaps, but to enhance collaboration with coastal communities and non-government organizations for coastal conservation.

Table 6.2 below summarizes some of the most relevant research initiatives that are underway in coastal Nova Scotia for MPA planning which are mentioned in this section and throughout this report.

Table 6.2 Summary of Current Coastal Research Initiatives Mentioned in this Report

Research Initiatives	Location
Broader Research Initiatives Within Study Area	
Inshore Ecosystem Project (IEP) and Ecosystem Overview and Assessment Report for the Inshore Scotian Shelf	• Cape Sable Island to Cape North, Cape Breton
Key Marine Habitats for Migratory Birds on Eastern Canada's Atlantic Coast project	• Atlantic Canada
DFO Long-term Temperature Monitoring Program	• Atlantic Canada
Site-specific Research Initiatives	
Site-specific research as part of IEP: • Fishery-independent survey • Underwater video survey • LEK survey	• LaHave area (site 4) • St. Margaret's Bay (site 6) • Mira Bay (site 9) • Chezzetcook to Jeddore Harbour (site 15) • Janvrin Island-Isle Madame area (site 18) • coastal area of western Sydney Bight (site 20)
Natural Geography Inshore Areas (NaGISA); Census of Marie Life Project	• Port Joli (site 3) • Canso (site 8)
NSDNR-DFO collaborative project on eelgrass mapping/monitoring	• Port Joli (site 3) • Musquodoboit Harbour (site 15)
Eelgrass mapping using Towfish (DFO Science)	• Bras d'Or Lakes (site 12)
Ongoing research through CEPI	• Bras d'Or Lakes (site 12)
CPAWS dive transects (transect complete, analysis underway)	• Port Joli (site 3) • Eastern Shore Islands Wildlife Management Area (site 7)
Bluenose Coastal Action Foundation (BCAF) conservation and research initiatives	• LaHave (site 4 - Petite Rivière watershed; water quality monitoring and whitefish recovery) • Mahone Bay (site 5; salmon and Roseate Tern recovery)
Bird banding (EHJV research)	• Chezzetcook to Jeddore Harbour (site 15)
Broader Research Initiatives Outside of Study Area (Potential Application in Study Area)	
Community Aquatic Monitoring Program (CAMP)	• Several sites in the southern Gulf of St. Lawrence and on the west coast Cape Breton (DFO's Gulf Region)

There are several data gaps to be addressed from an ecological perspective, however, there are also several socio-economic information gaps. Fisheries information of the twenty sites is not completely accurate and more detailed information is required. Socio-economic considerations must be incorporated into the network planning process following the identification of ecological priority sites. Additionally, the linkages between human activities and ecological impacts is a major gap where further research is required, as mentioned in Section 5.0.

Although there are several coastal data gaps, the precautionary approach should be taken; management action should not be delayed due to scientific uncertainty. Sites of known ecological significance, as identified in the 2006 EBSA exercise and other research initiatives, and areas that are threatened by human uses should be given priority for conservation while research efforts are underway.

7.0 Next Steps

This effort was intended to help advance DFO's MPA Program, protected area programs of other federal and provincial departments, and coastal management more generally by identifying and presenting information on areas that need further evaluation as potential priority areas for coastal conservation. These areas may also contribute to the bioregional network of MPAs. This work provides useful information for broader conservation measures and coastal zone management. A coastal conservation areas planning and implementation framework must be developed to outline a process for further evaluating these areas. While this is in development, more detailed socio-economic information should be collected for each site. This is an immediate next step that can occur simultaneously with engagement of Aboriginal groups, stakeholders, and governments which is an essential element of this work that must occur early and throughout the process of identifying priority areas for conservation.

The coastal conservation areas planning and implementation framework has not been developed and the identification of key elements in its overall design is an essential next step of this work. Identifying conservation objectives for the entire coast is an important next step which will require stakeholder input. Conservation objectives should align with the mandates and legislation of federal and provincial departments responsible for coastal and marine conservation as well as international guidelines for MPA establishment, such as those developed under the Convention on Biological Diversity (CBD), for which Canada is signatory. The CBD's COP 9 Decision IX/20 on marine and coastal biodiversity provides internationally recognized scientific guidance for selecting areas within a representative MPA network (CBD 2008).

Other required network components, as per the CBD COP Decision IX/20, include: Ecologically and Biologically Significant Areas, representativity, connectivity, replicated ecological features, and adequacy and viability (CBD 2008). The coastal conservation planning process should follow the CBD criteria to the extent possible, as Canada is signatory to the CBD and is therefore committed to the establishment of a national network of representative MPAs by 2012.

The representativity component can potentially be addressed using work completed by M. Greenlaw (2009) in which inlets along the Atlantic Coast are classified using geophysical information to define ecological representation. Identifying representative areas is an approach that uses physical variables as a surrogate in the absence of biological information (Greenlaw 2009). As consistent biological information along the Atlantic coast of Nova Scotia is unavailable, Greenlaw's work can provide a valuable data set for setting representation goals and objectives for a coastal conservation areas network. Greenlaw's classification covers a portion of the coast along mainland Nova Scotia; expansion to the coastal zone of Cape Breton is required to fully incorporate representativity into network design for this study area. In addition to Greenlaw's work, there is work underway within DFO Science to determine biological distribution using physical surrogates in the offshore. Some of these methods may be applied to the coastal environments. The "Framework for Classification and Characterization of Scotia-Fundy Benthic Habitats" (DFO 2005b) developed by Vladimir Kostylev in DFO Science and work by Pitcher *et al.* (In press) on the role of physical environmental variables in shaping patterns of biodiversity will help inform coastal classification work.

Once these components are assembled, potential priority sites can then be identified and further evaluated through a science-based evaluation and stakeholder input. As more information becomes available other sites in addition to the twenty sites in this report may be identified as ecologically significant and should also be evaluated. The data gaps highlighted in Section 6.0 should be addressed where possible in order to increase the understanding of the ecological and socio-economic significance of these coastal areas. This can occur in parallel with many of the other next steps for conservation planning.

Furthermore, an assessment of the sensitivity of coastal areas along the Atlantic coast of Nova Scotia may also be required. This would be a component of the network design that would help incorporate both relatively pristine areas and areas experiencing significant human impacts where restoration can occur.

After the identification of priority areas for coastal conservation, conservation needs should be effectively addressed by implementing appropriate management measures by the relevant responsible agencies. Management measures may include federal MPAs, provincial protected areas, municipal bylaws and policies, fisheries management measures such as fisheries closures, private land conservation, voluntary initiatives, or other management measures. This process will take place over the long-term to ensure effective stakeholder engagement throughout the process. It should be emphasized that progress on this work does not preclude advancing of the conservation requirements of any particular site in the study area, including those identified in this report. The appropriate agency can utilize its respective program requirements (*e.g.* DFO's MPA Program and Nova Scotia Environment's program for establishing a provincial protected areas system) at any point to advance existing or future public commitments.

8.0 Conclusion

This report examines ecological and human use information on twenty sites along the Atlantic coast of Nova Scotia. These sites provide a starting point for the identification of priority areas for coastal conservation on the Atlantic coast of Nova Scotia which may include the implementation of a variety of management measures by federal and provincial departments. Much work remains in the design and selection of priority areas for coastal conservation including: engaging stakeholders and other government departments, collecting more detailed socio-economic information for each site, establishing conservation objectives and targets, addressing data gaps, and examining additional sites for ecological significance as new information becomes available.

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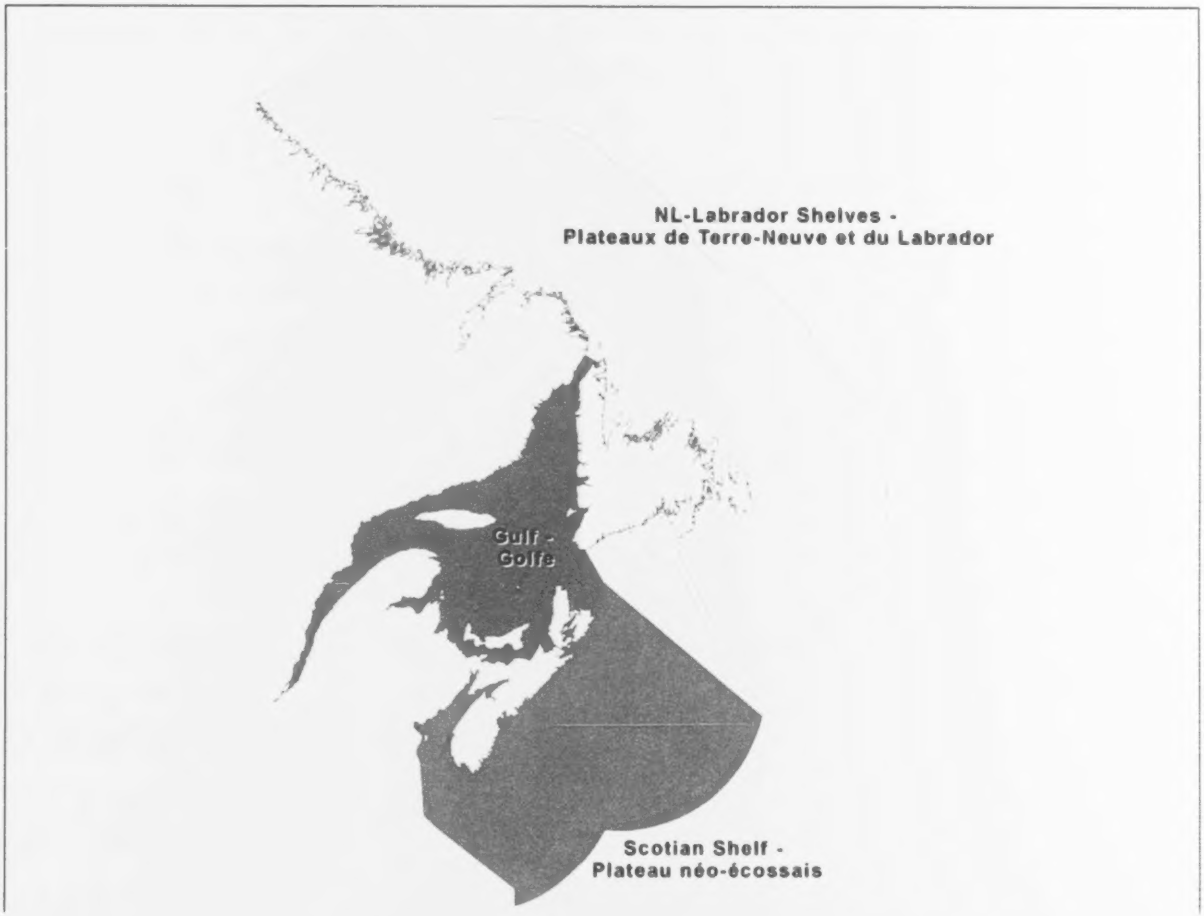
Appendix A Accepted Major Biogeographic Units for the Canadian Atlantic Ocean


NL-Labrador Shelves -
Plateaux de Terre-Neuve et du Labrador
Gulf -
Golfe
Scotian Shelf -
Plateau néo-écossais

Accepted major biogeographic units for the Canadian Atlantic Ocean. Units are delineated as follows: Newfoundland-Labrador Shelves, Gulf of St. Lawrence, and Scotian Shelf. (DFO 2009a).

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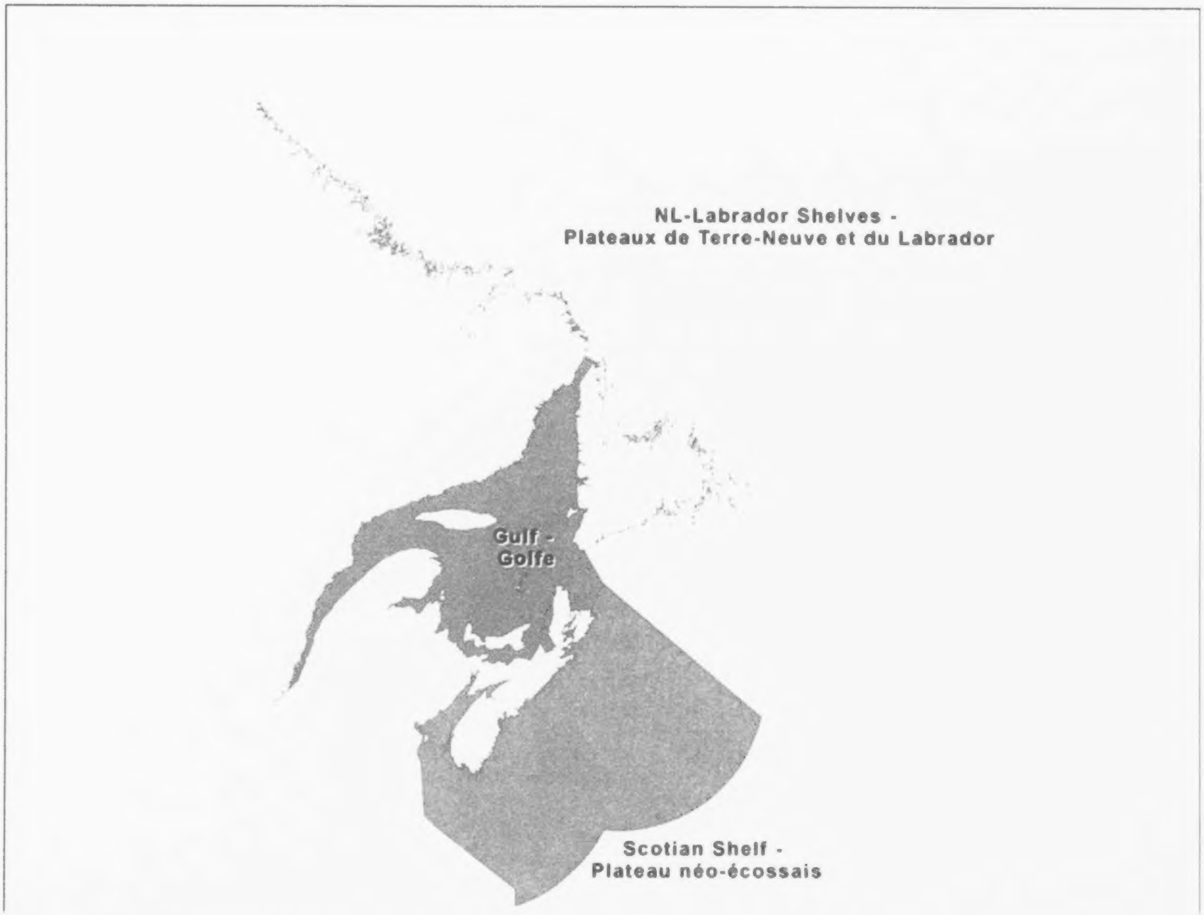
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Appendix B Summary of Provincial Protected Areas and Supporting Legislation (Gromack 2008)

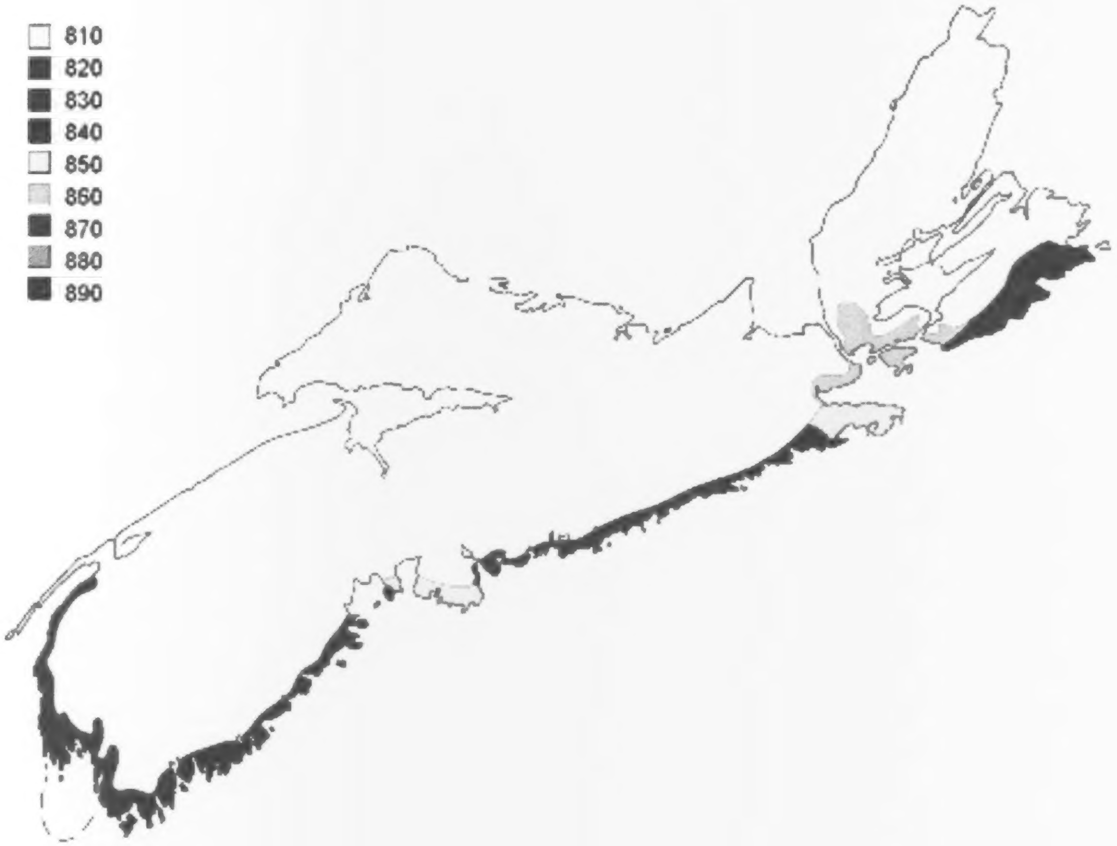
Summary of Provincial Protected Areas and Supporting Legislation (Gromack 2008)

Designating Department	Designation	Supporting Legislation	Purpose for Protection and Regulations Applicable to Marine Environment	Designations With Marine Components
NSDNR Parks and Recreation Division	Protected Beaches	*Beaches Act*	• Purposes: protects beaches and dunes for their environmental significance to provide for the enjoyment of future generations; protects coastal processes • ensures the regulation and enforcement of land-use activities, such as the removal of aggregate, and of recreational activities that may impact the beach and dune systems; regulates boating • regulation of shoreline construction ex: wharfs, moorings, breakwaters occurs under the Crown Lands Act administered by DNR Parks and Recreation	• Some beaches (not identified) have marine components
	Provincial Parks (or Park Reserve)	*Provincial Parks Act*	• Purposes: provides opportunities for recreation, education, and appreciation of natural and cultural heritage; preserves and protects rare, representative, and significant elements of natural and historic resources of Nova Scotia. • regulates recreational activities, i.e. boating; regulations are vague: prohibiting or regulating any activity occurs in pursuant with this Act	• McNabs and Lawlor Islands • West Mabou Beach • Cape Chignecto • Thomas Raddall • Summerville Beach
NSDNR Wildlife Division	Wildlife Management Areas (WMAs) and Game Sanctuaries	*Wildlife Act*	• Purpose: provide for the protection, management and conservation of wildlife and wildlife habitats • primarily provides wildlife for protection against hunting with some regulations applying to habitat protection	• Abercrombie WMA • Antigonish WMA • Eastern Shore Islands WMA • Grassy Island WMA • Pearl Island WMA • Scatarie Island WMA • The Brothers Islands WMA • Cape Sable Island, Peter-McNab-Khun, and Minas Basin *candidate* WMAs

Summary of Provincial Protected Areas and Supporting Legislation (Gromack 2008) (Continued)

Designating Department	Designation	Supporting Legislation	Purpose for Protection and Regulations Applicable to Marine Environment	Designations With Marine Components
NS Environment	Wilderness Areas	*Wilderness Areas Protection Act*	• Purposes: provides for the establishment, management, protection and use of wilderness areas, in perpetuity; maintaining ecosystem integrity, providing educational opportunities, and promoting community stewardship • prohibits an abundance of activities from the development or construction of energy resources and aquaculture activities to the removal or destruction of any natural object, flora or fauna, whether living or dead	None
	Nature Reserves (ecologically significant Special Places)	*Special Places Protection Act*	• Purposes: provides for the preservation, regulation and study of ecological sites; protects areas of significance to provide educational and appreciation opportunities and may also serve as examples of areas which man has altered and recovery can be observed; protects representative examples of ecosystems; protects rare and endangered species and their habitats • regulations can be made to control or prohibit any kind of use, development or occupation of the land or of any of the natural resources in a special place and respecting any other matter or thing necessary for the protection of special places	None
NS Department of Tourism, Culture and Heritage	Special Places or Protected Sites (of historical, archaeological, and palaeontological significance)	*Special Places Protection Act*	• Purposes: provides for the preservation, regulation and study of archaeological and historical remains and palaeontological sites; protects areas of significance to provide educational and appreciation opportunities and may also serve as examples of areas which man has altered and recovery can be observed • for regulations see above (NS Environment)	• Joggins Fossil Cliffs • Parrsboro Fossil Site

Appendix C The Atlantic Coast of Nova Scotia Theme Region and its Nine districts

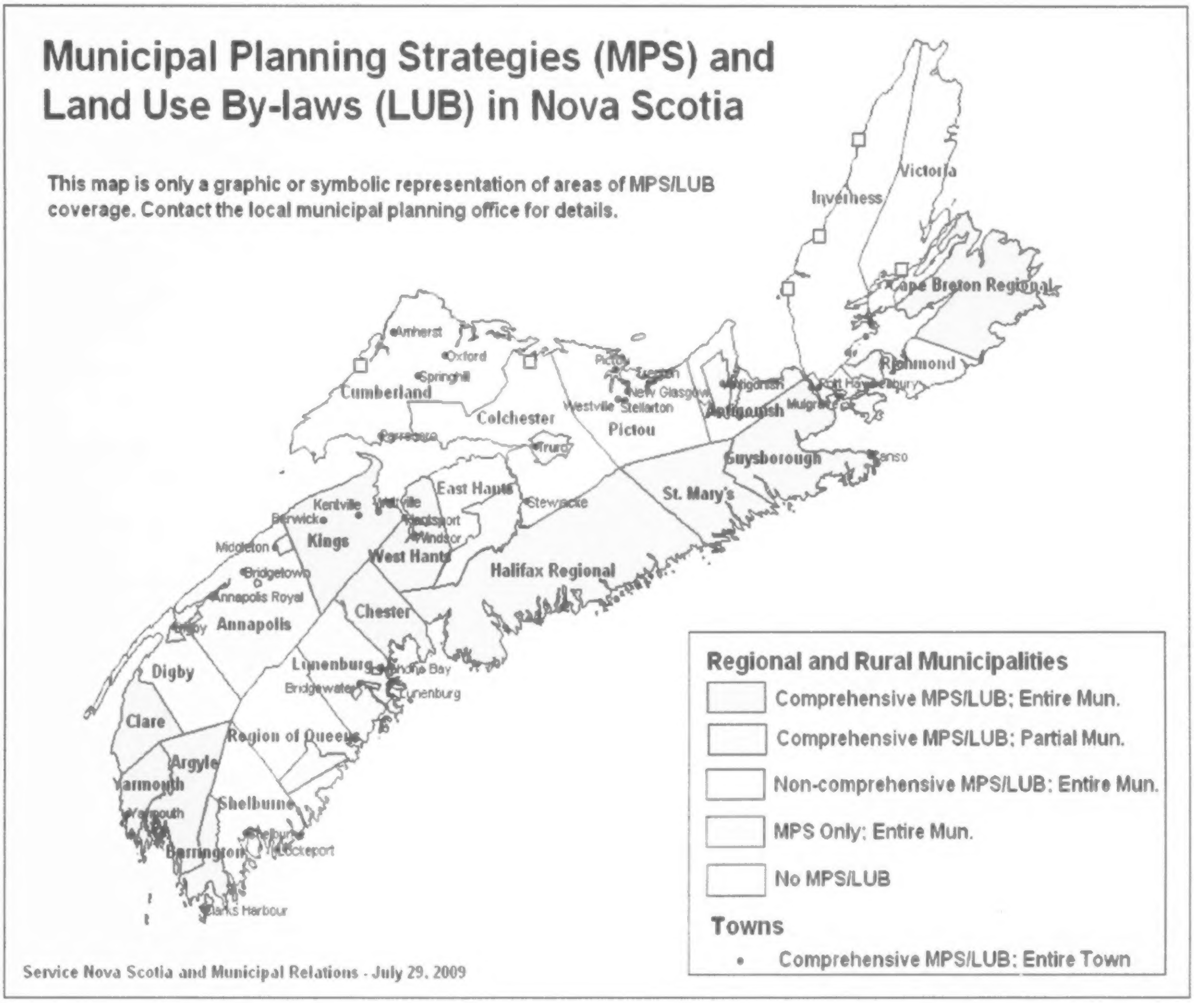


The Atlantic coast of Nova Scotia theme region and its nine districts (Davis and Browne 1996b)

Nine Districts (Davis and Browne 1996b):

810 Basalt Peninsula
820 Cliffs and Beaches
830 Beaches and Islands
840 Quartzite Headlands
850 Granite Barrens
860 Sedimentary Lowland
870 Till Plain
880 Cliffed Island
890 Sandy Island

Appendix D Areas in Nova Scotia with Municipal Planning Strategies and or Land Use Bylaws



Municipal Planning Strategies (MPS) and Land Use By-laws (LUB) in Nova Scotia

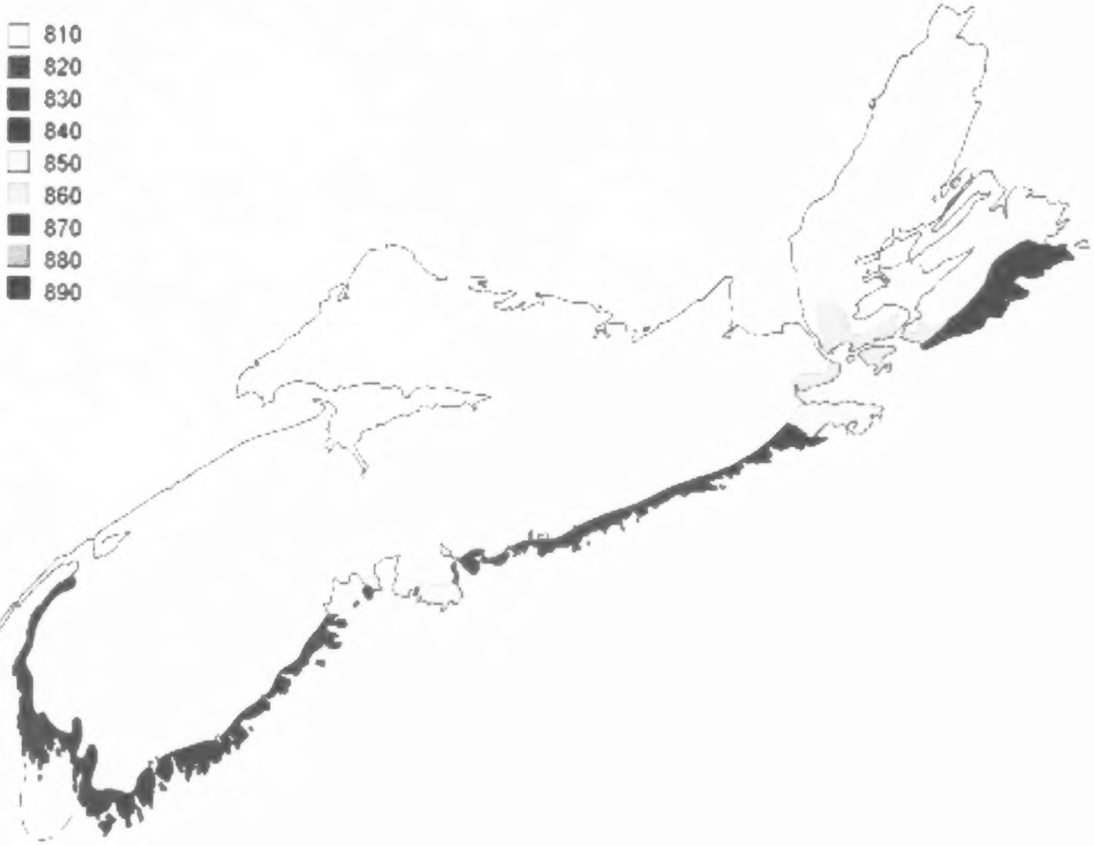
This map is only a graphic or symbolic representation of areas of MPS/LUB coverage. Contact the local municipal planning office for details.

Victoria
Inverness
Cape Breton Regional
Richmond
Port Hawkesbury
Mulgrave
Antigonish
Antigonish
Guysborough
Canso
St. Mary's
Pictou
Trenton
New Glasgow
Westville
Stellarton
Pictou
Amherst
Oxford
Springhill
Cumberland
Colchester
Parrsboro
Truro
East Hants
Stewiacke
Kentville
Wolfville
Berwick
Hantsport
Windsor
Kings
West Hants
Middleton
Bridgetown
Annapolis Royal
Halifax Regional
Digby
Annapolis
Chester
Lunenburg
Mahone Bay
Bridgewater
Lunenburg
Digby
Clare
Region of Queens
Argyle
Yarmouth
Yarmouth
Shelburne
Shelburne
Lockeport
Barrington
Clark's Harbour
Regional and Rural Municipalities
☐ Comprehensive MPS/LUB; Entire Mun.
☐ Comprehensive MPS/LUB; Partial Mun.
☐ Non-comprehensive MPS/LUB; Entire Mun.
☐ MPS Only; Entire Mun.
☐ No MPS/LUB
Towns
• Comprehensive MPS/LUB; Entire Town

Service Nova Scotia and Municipal Relations - July 29, 2009

Areas in Nova Scotia with Municipal Planning Strategies and or Land Use Bylaws (Service Nova Scotia and Municipal Relations 2007 *in* CBCL Limited 2009)

Appendix C The Atlantic Coast of Nova Scotia Theme Region and its Nine districts



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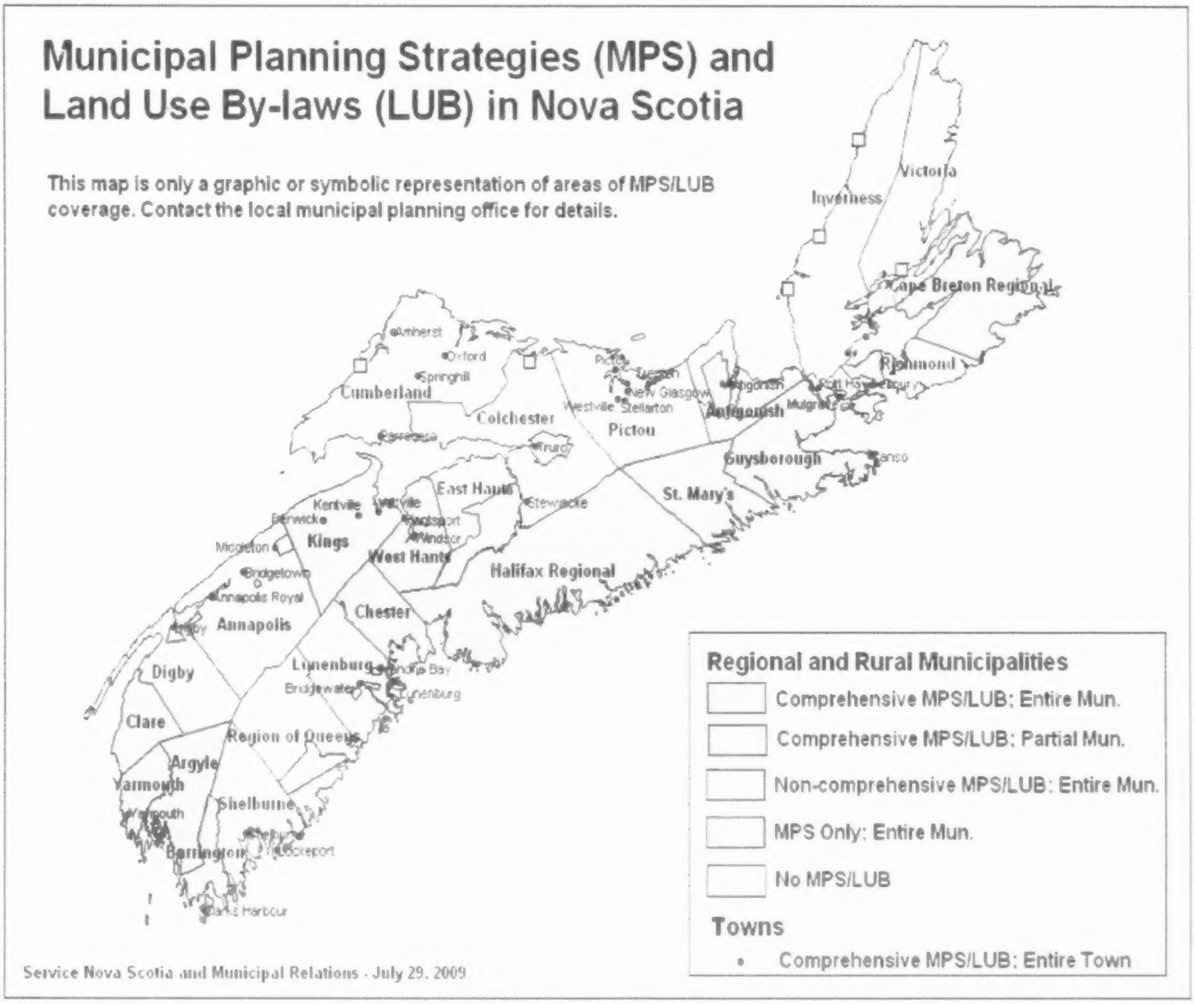
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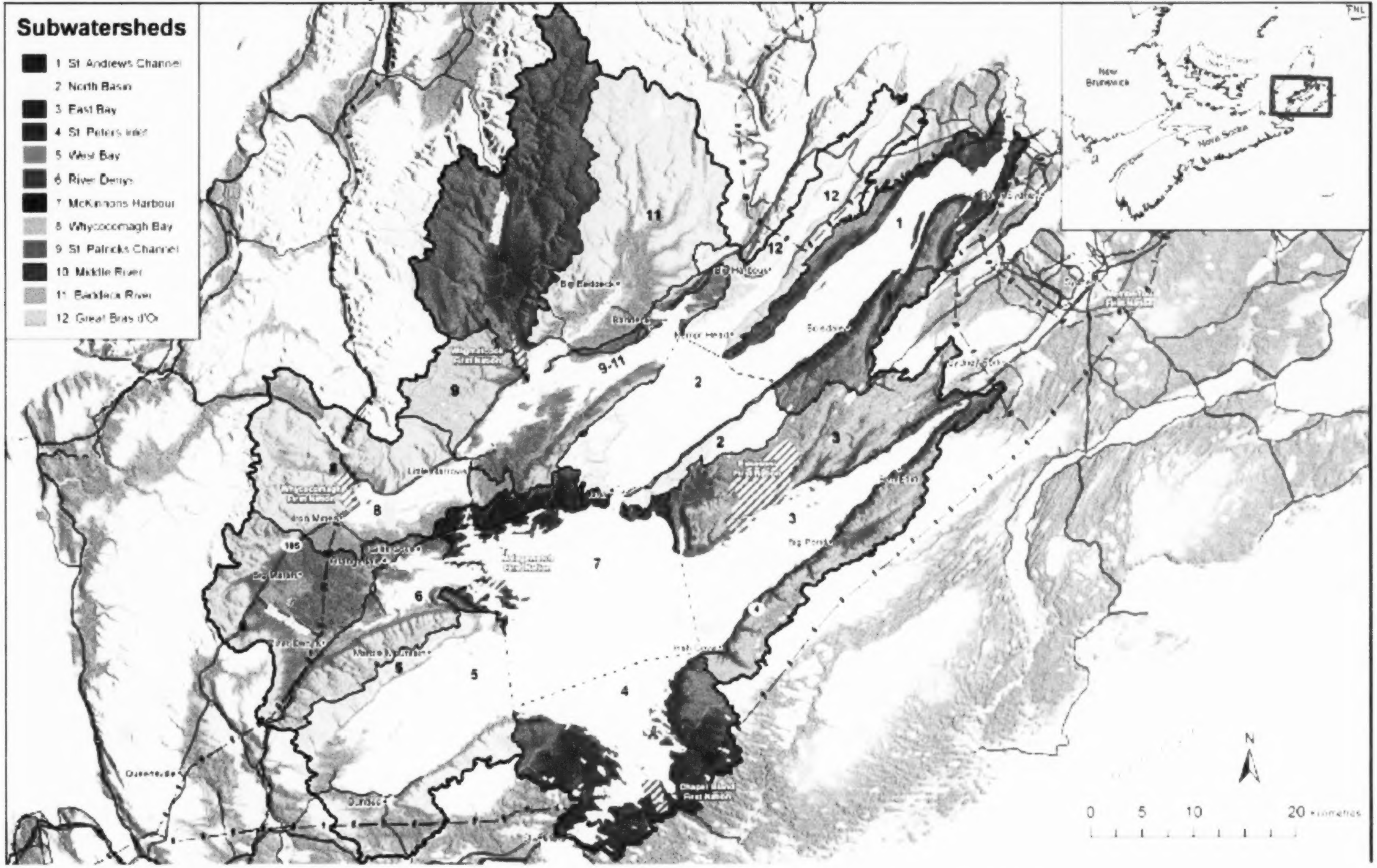
Richmond
Antigonish
Mulgrave
Guysborough
Canso
Pictou
Trenton
New Glasgow
Westville
Stellarton
St. Mary's
Halifax Regional
Colchester
Truro
Stewiacke
Cumberland
Amherst
Oxford
Springhill
East Hants
West Hants
Windsor
Kentville
Berwick
Kings
Middleton
Bridgetown
Annapolis Royal
Annapolis
Digby
Chester
Lunenburg
Mahone Bay
Bridgewater
Clare
Region of Queens
Argyle
Yarmouth
Shelburne
Barrington
Lockeport
Clark's Harbour
Regional and Rural Municipalities
Comprehensive MPS/LUB: Entire Mun.
Comprehensive MPS/LUB: Partial Mun.
Non-comprehensive MPS/LUB: Entire Mun.
MPS Only: Entire Mun.
No MPS/LUB
Towns
• Comprehensive MPS/LUB: Entire Town

Service Nova Scotia and Municipal Relations - July 29, 2009

Areas in Nova Scotia with Municipal Planning Strategies and or Land Use Bylaws (Service Nova Scotia and Municipal Relations 2007 *in* CBCL Limited 2009)

Appendix E Overview of the Bras d'Or Lakes Showing Approximate Boundaries of the Twelve Major Sub-watersheds and Ten Bay-scale Areas


Subwatersheds
1 St Andrews Channel
2 North Basin
3 East Bay
4 St Peters Inlet
5 West Bay
6 River Denys
7 McKinnons Harbour
8 Whycocomagh Bay
9 St Patricks Channel
10 Middle River
11 Baddeck River
12 Great Bras d'Or
New Brunswick
Nova Scotia
N
0 5 10 20 Kilometres

Overview of the Bras d'Or Lakes Showing Approximate Boundaries of the Twelve Major Sub-watersheds and Ten Bay-scale Areas
Data Sources: DFO (2003); NSGC (1999); Basemap (Natural Resources Canada, National Topographic Database 1:250,000 3rd edition). In Parker et al. 2007.

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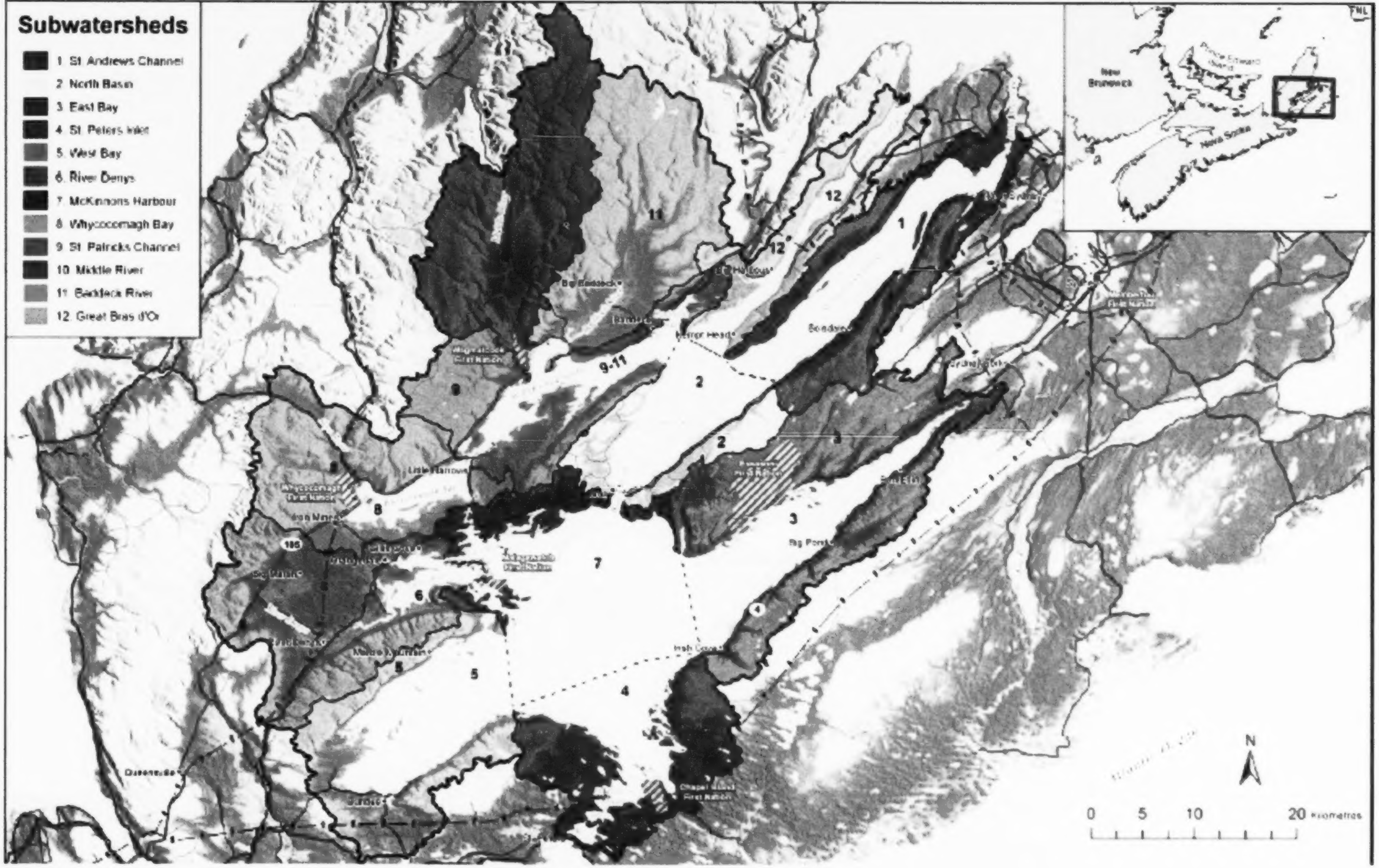
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12 Great Bras d'Or
New Brunswick
Prince Edward Island
Nova Scotia
NFL
1
2
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4
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7
8
8
9
9-11
11
12
12
Big Baddeck
Baddeck
Boularderie
Little Narrows
Whycocomagh First Nation
Iron Mines
Big Pond
Irish Cove
Chapel Island First Nation
N
0
5
10
20 Kilometres

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